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10.1 Fundamentals

LASER = **L**ight **A**mplification by **S**timulated **E**mission of **R**adiation

Lasers, as all technical facilities, equipment and devices, must comply with the objectives of the safety regulations anchored in the Swiss Federal Law.

The Laser Safety Officer provides advice to the Project Leaders regarding the law and guidelines and carries out checks to ensure that the laser safety guidelines are followed.

The Group Leader is responsible for laser safety in labs where work involving lasers is carried out. It is their duty to ensure that their workers are instructed in safe operating procedures specific to the equipment being used and that the appropriate safety measures for protection from laser radiation are met. In addition, it is mandatory for all persons working with lasers of Class 3 or greater to complete the E-learning Program for laser safety.

Schall- und Laserverordnung SLV (Swiss Federal Legislation dealing with laser safety)

10.2 Persons Responsible

Laser Safety Officer:
Roland Steiner, Tel. internal: 7 37 27

Occupational Safety Officer:
Laurent Marot, Tel. internal: 7 37 20

10.3 Laser Classes

(According to European norm EN 60825-1/ November 2001)

In order to classify lasers according to the degree of danger each individual laser potentially holds, they are assigned to a Laser Class. This classification is based on the so-called AELs – accessible emission limits - (German: GZS-Werte). The AELs have been derived from the medical MPE values - maximum permissible exposure - (German: MZB Werte), which indicate at which level of exposure laser radiation is dangerous for the eyes or skin.

Class	Concept	Comment
1	The radiation emitted by this laser is not dangerous.	No need for protection equipment.
1M	Eye safe when used without optical instruments; may not be safe when optical instruments are used.	No need for protection equipment, if used without optical instruments.
2	Eye safe due to the aversion response including the blink reflex.	No need for protection equipment.
2M	The light that can hit the eye has the value of a class 2 laser. Depending on a divergent or widened beam, it may not be safe when optical instruments are used.	No need for protection equipment, if used without optical instruments.
3R	The radiation from this laser exceeds the MPE values (MPE: maximum permissible exposure). The radiation is max. 5 x AELs of class 1 (invisible) or 5 x of class 2 (visible). The risk is slightly lower than that of class 3B.	Dangerous to the eyes, safety glasses are recommended.
3B	Old class 3B without 3R. The view into the laser is dangerous. Diffuse reflections are not regarded as dangerous.	Dangerous to the eyes, safety glasses are obligatory.
4	Old class 4. Even scattered radiation can be dangerous, also danger of fire and danger to the skin.	Personal safety equipment is necessary (glasses, screens).

10.4 Labeling of Designated Laser Areas and Lasers

10.4.1 Labeling of Designated Laser Areas

The areas in which class 3 and class 4 lasers are used must be marked with warning signs as follows:

Laser Warning Symbol (triangle)

Laser Class Warning Labels e.g.

10.4. Labeling of Lasers

Each laser must be marked with a **laser warning symbol (triangle)** and a **laser class warning label**

In addition the laser must be labeled with
technical details regarding its laser beam:

English:

Laser details

Laser medium……

Emitted wavelength……..

Pulse duration …….....

Beam power density……

Beam energy density……..

The above mentioned labels are available from Peter Reimann Tel: 73685

10.5 Protective Measures in the Range of Class 3 and Class 4 Lasers

By applying the appropriate safety measures, the operator of a laser facility is responsible to ensure that no individual can be injured accidentally due to laser radiation. The operation of Class 3 and Class 4 lasers requires the implementation of additional protective measures.

10.5.1 Structural Protective Measures

Walls, ceilings, floors:	Fire proof, light coloured and matt finished
Lighting:	Ample and effective lighting and if possible a dimmer switch for brightness control
Fittings:	Non-metal (non-reflective surfaces)
Switches:	Must be safe to operate Emergency shut-off switch must be installed
Beam line:	Beam should be enclosed when possible.
Screens:	Scattered radiation to be kept to the minimum possible High absorption, low flammability
Designated Laser Areas:	Closed off area, marked with Laser warning signs Entry for authorized persons only
Fire extinguishers:	Compulsory for Class 4 Laser Areas (carbon dioxide B/C/E)

In rooms where Class 4 lasers are in use, a warning light must be installed at each entrance.

10.5.2 Organisational Protective Measures

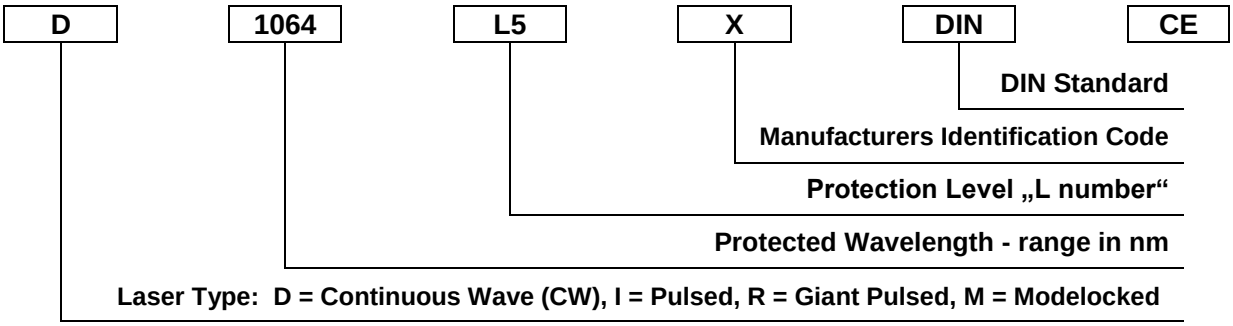
Personal protective clothing (PSA):	Appropriate laser safety eyewear, protective alignment glasses, lab coat and when required gloves are to be worn
Operating instructions:	Must be readily available at each laser
Training:	Compulsory

10.6 Eye Protection

Through laser protection eyewear, the maximum beam power that could potentially hit the eye must be reduced to the MPE value (German: MZB-Wert) (see Part 10.3) for a specified wavelength range in use. For complete eye protection from laser radiation, so-called a blockout eyeshield is required. Both the filter and the frame must be chosen specifically to protect for the maximal potential beam intensity and characteristics of the laser to be used.
→ Ask for advice (zB. Laservision)

A distinction is made between protective glasses and alignment glasses:
Protective glasses reduce the intensity of a hit with the laser beam to under the MPE (German: MZB-Wert).
Alignment glasses make it possible to provide protection while allowing the wearer to safely view the visible beam spot. The MPE (MZB-Wert) is marginally exceeded during the alignment process.

The following labeling should be visible on all protective eyewear or filters:



In principle the following rules apply:
Never look directly into the laser beam!
Never bring your eyes to the level of the laser beam!

10.7 What to do in the event of an Accident

If medical assistance is required, there is a trained First Aid Assistants on the floor for emergency assistance. Otherwise please call direct the Eye Hospital.

Tel. 061 265 87 87

Should eye exposure to a laser beam be suspected, the injured individual is to be taken immediately to the Augenspital (Eye Hospital, Mittlere Strasse 91) accompanied by a First Aid Assistant.
→ Inform the Laser Safety Officer!

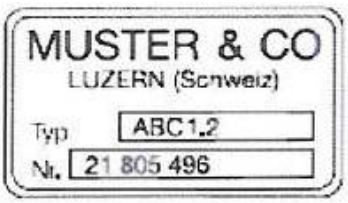
Augenklinik (Eye Hospital) Emergency Department (24 hour service) Tel. 061 265 87 87

10.8 Checklist when you purchase a small open beam laser

Should you answer any of the following questions with „☒ **No** “, the provider must provide the missing information or labeling. If not, do not buy the laser.

Identification

1 Is the laser labeled with information about the Manufacturer or Distributer, type of device, Serial number etc. (Identification Plate) providing clear identification? ☐ **Yes** ☐ **No**



Example of an identification plate

Labeling

Lasers hold an unaccustomed and often hidden danger. For this reason there is **mandatory labeling** that with the help of the Laser Class provides orientation regarding the potential hazard and the appropriate safety guidelines adhered to and measures to be met.*

2 Is the laser labeled with a **Laser warning symbol (triangle)**? ☐ **Yes** ☐ **No**

Laser Hazard Symbol (Suva Order-No: 1729/22)

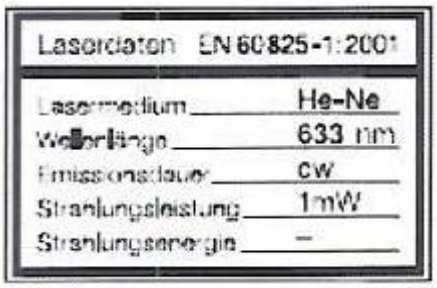
3 Is the laser marked with a **Laser Class Warning Label** stating Class of laser and appropriate warning text? ☐ **Yes** ☐ **No**

Laser Class Warning Label (Suva Order-No: 1729/20)

4 Is the laser labeled with the **technical details about the laser beam**?

Minimal details:
- Wavelength
- Radiation density/radiation energy with laser pulse mode type
- Beam dimension e.g. beam diameter at a 100mm interval (only required for classes 1M, „M and 3A)

☐ **Yes** ☐ **No**



Technical details plate (Suva Order-No: 1729/31)

5 In devices where the laser radiation is not visible to the human eye, is the comment **laser radiation invisible** displayed? ☐ Yes ☐ No

Instruction Manual

6 Does a comprehensive instruction manual come with the laser? Is it readily at hand for the user? ☐ **Yes** ☐ **No**

A Comprehensive instruction manual includes, depending on the complexity of the laser, instructions for use, safety advice, instructions for installation and maintenance.

Declaration of Conformity

7 Is a Conformity Declaration from the Distributor available for lasers manufactured after 1997? ☐ **Yes** ☐ **No**

*The laser details must always be listed in the instructions for use. For all lasers of Class 2 or more, the laser details must also be displayed on the device. For small lasers, this information can be added to the user’s instructions or on the packaging.

Should the operator make any alteration to the laser equipment, he must fulfil the same requirements as the Distributor!

10.9 Links

BAG-Homepage
Swiss Federal Office of Public Health (FOPH) homepage

Schall- und Laserverordnung, SLV
Swiss Federal Legislation dealing with laser safety (in German)

SUVA Informationsblatt: Achtung Laserstrahl
SUVA information booklet: Caution Laser Beam (in German)

http://www.uvex-laservision.de/fileadmin/user_upload/Download/Laservision-Laserschutzhandbuch-Guide.pdf (Laservision)
Guide to Laser Safety (both German & English)

10.10 Appendix

Ten short rules for working with lasers (workplace version):

1. Do not look into the laser beam.
2. Keep room lights on brightly if possible.
3. Remove personal jewelry.
4. Locate and terminate all stray laser beams.
5. Lamp optical components securely.
6. Keep beams horizontal.
7. Do not bend down below beam height.
8. Remember, optical components reflect, transmit and absorb light.
9. Do not forget non-optical hazards.
10. Wear laser safety eyewear.