

# CONTROL MEASURES

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The use of Class 3b and Class 4 lasers requires special control measures.

Due to the potential hazard caused by most health care laser systems, administrative control measures are required to ensure a safe use of Class 3b and Class 4 lasers. The American National Standard ANSI Z136.3 provides guidance for the safe use of lasers in health care facilities.



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Laser safety officers support the safe operation of laser products.

The laser safety officer (LSO) has the responsibility and authority to monitor and enforce the control of laser hazards and effect the knowledgeable evaluation and control of laser hazards.

He/She should

- ensure that a risk analysis of laser controlled areas is carried out and establish a nominal hazard zone (NHZ)
- approve standard operating procedures (SOPs)
- conduct periodic facility and equipment audits
- avoid unnecessary controls
- assist with the training of laser users
- select personal protective equipment

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The laser treatment controlled areas have to be clearly labeled.

In a laser treatment controlled area, persons may be exposed to Class 3b and Class 4 laser radiation. Normally, a laser treatment controlled area is a room in which a laser is operated. It contains the NHZ (nominal hazard zone).

In order to achieve a safe operation, doors and windows of such areas require [warning signs]. Warning signs must be clearly attached outside the room where the laser procedure is being performed.

Access should be restricted to authorized persons.

On entering laser treatment controlled areas, laser protective eyewear with a dequate optical density (OD) at the wavelength in use has to be worn.

Using endoscopes, microscopes or video monitors does not preclude the laser beam being emitted from a break in the optical fiber.

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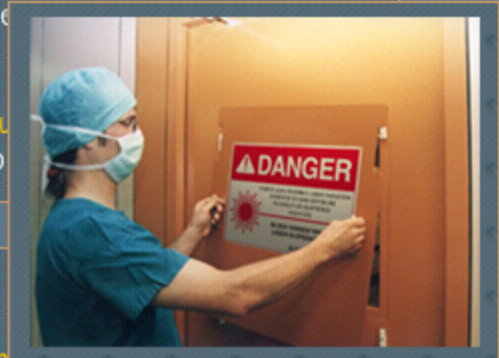
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Windows and doorways within the nominal hazard zone shall be protective.

Ordinary glass transmits visible and near infrared wavelengths. For this reason windows [often] do not protect against laser radiation.

When operating [such lasers], windows within the NHZ shall either be provided with blocking barriers or absorbing filters in such a way as to reduce the transmitted laser radiation to levels at or below the applicable MPE.

Doorways within the NHZ shall also be protective.

Hazard zones can thus be reduced to laser controlled areas.  
Persons outside laser controlled areas are not at risk.



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Usually windows do not transmit wavelengths below 300 nm and above 4  $\mu\text{m}$ . Therefore windows protect against radiation emitted by CO<sub>2</sub> lasers as well as some excimer lasers. Other laser wavelengths, however, may be transmitted by glass and therefore have to be blocked.



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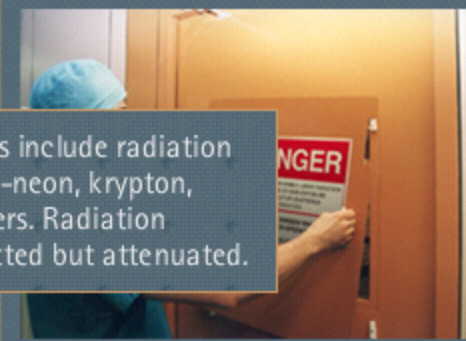
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Wavelengths transmitted by ordinary window glass include radiation from argon, gold or copper vapor, dye, KTP, helium-neon, krypton, ruby, alexandrite, Ti:sapphire, diode or Nd:YAG lasers. Radiation from XeCl, XeF, Ho:YAG or Er:YAG lasers is transmitted but attenuated.



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Reflections of laser beams shall be avoided.

A specularly reflected laser beam is as hazardous as a direct beam. Incidental reflections of laser beams on specular surfaces are hazardous to the eyes and skin. For this reason, the beam has to be directed very carefully.

Medical equipment, which might be exposed to laser radiation should have dull instead of [specular] surfaces ! Use anodized or matte instruments with visible and near infrared laser as to minimize reflection hazards. This will ensure low specular or diffuse reflection from a direct or scattered laser beam.

Gel used in dermatology to provide cooling and to protect from unintentional surface damage may also act as a reflecting surface !



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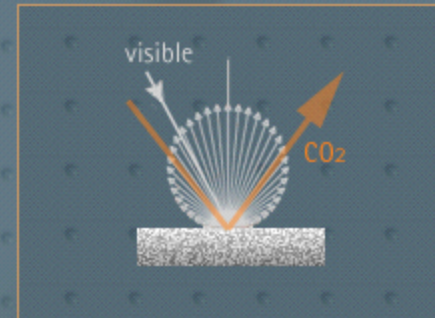
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The reflection from surfaces is depending on the wavelength. A surface which appears rough in visible light may be specularly reflecting for CO<sub>2</sub> laser radiation !

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## Health care laser systems must be safeguarded.

Every health care laser system has to be labeled, indicating  
the class of laser  
the type of laser  
the emitted wavelength  
the maximum output power or energy

A safe use of health care laser systems is achieved if only authorized persons have access to the lasers. This can be accomplished by key controlled switches.

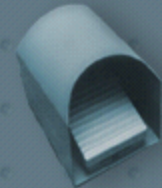
An accidental and potentially hazardous triggering of lasers can be avoided by pedal switches. All foot controlled switches must be covered to prevent accidental activation of the laser.

Class 3b and Class 4 lasers require emergency shutoff switches to enable rapid shutdown of the laser emission.

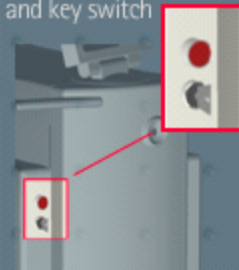
labels



pedal switch



emergency shutoff switch  
and key switch



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All users of Class 3b and Class 4 lasers need to be trained.

The safe operation of lasers requires a adequate **training** of all users. Hazardous situations can only be avoided by educating all personnel who work in a laser controlled area.

Written **safety instructions** and **standard operating procedures** should be provided with every laser. SOPs should cover both the beam related and non-beam hazards.

Regular checks of hazard **[sources]** in the hazard area as well as checks of **[safety installations]** add to the overall safety standard. Checks of cables and beam delivery systems before operating a laser are recommended.

In order to accomplish the safe application of lasers, all personnel working in the nominal hazard zone should wear personal **[protective equipment]**.

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Fiber optics, chemical hazards, electrical hazards, fire hazards.

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## What shall be done in case of an accident ?

Every incident caused by the use of lasers shall be reported to the laser safety officer immediately.  
He/She will take all further steps.

Any incident including fire, inadvertent patient or personnel harm by the laser with tissue damage beyond that expected from therapeutic laser use must be reported to the FDA.

Following the standard ANSI Z136.3, medical surveillance such as pre-employment eye examinations and after suspected abnormal exposure is required for Class 3b and Class 4 lasers.

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