

Laser Safety Guidelines

Laser light, because of its special properties, poses safety hazards not associated with light from conventional sources. The safe use of lasers requires that all laser users, and everyone near the laser system, are aware of the dangers involved. The safe use of the laser depends upon the user being familiar with the instrument and the properties of coherent, intense beams of light.

The greatest concern when using a laser is eye safety. Most lasers are capable of causing eye injury to anyone who looks directly into the beam. In addition to the main beam, there are often many smaller beams present at various angles near the laser system. These beams are formed by specular reflections of the main beam at polished surfaces such as lenses or beam splitters. While weaker than the main beam, such beams may still be sufficiently intense to cause eye damage.

High power laser beams are powerful enough to burn skin, clothing or paint. They can ignite volatile substances such as alcohol, gasoline, ether and other solvents, and can damage light-sensitive elements in video cameras, photomultipliers and photodiodes.

LASER CLASSIFICATION

The government recommended safety practices for a given laser system will depend on its classification. The following highlights the criteria are used to classify lasers, as well as the key safety considerations when operating a system with the indicated classification. The reader is directed to the "Code of Federal Regulations" for a comprehensive discussion of these safety topics.

Classification Criteria

Wavelength: If the laser is designed to emit multiple wavelengths the classification is based on the most hazardous wavelength.

Output Characteristics:

For continuous wave (CW) or repetitively pulsed lasers the average power output (Watts) and limiting exposure time inherent in the design are considered.

For pulsed lasers the total energy per pulse (Joule), pulse duration, pulse repetition frequency and emergent beam radiant exposure are considered

Class I Lasers

Low-power lasers and laser systems that cannot emit radiation levels greater than the Maximum Permissible Exposure (MPE). Class 1 lasers and laser systems are incapable of causing eye damage. These systems are also classified as, or termed, "Exempt" lasers. They are normally not hazardous with respect to continuous viewing, or are designed in a way that prevents human access to laser radiation (E.g., laser printers).

Class II Lasers (Low Risk)

Visible, low power lasers or laser systems that are incapable of causing eye damage unless they are viewed directly for an extended period (greater than 1000 seconds). They are less than 1 mW in power.

Class III Lasers (Moderate Risk)

Medium-power lasers and laser systems capable of causing eye damage with short-duration (<0.25 s) exposures to the direct or specularly reflected beam. Includes Class 3a and 3b lasers.

Class 3a : Lasers or laser systems that normally would not produce a hazard if viewed for only momentary periods with the unaided eye. They may present a hazard if viewed using collecting optics. They have power levels between 1 and 5mW.

Class 3b : Lasers or laser systems that can produce a hazard if viewed directly. This includes intrabeam viewing of specular reflections. They have power levels between 5 and 500 mW.

Class IV Lasers (High Risk)

High power lasers and laser systems (> 500 mW) capable of causing severe eye damage with short-duration (<0.25 s) exposures to the direct, specularly reflected, or diffusely reflected beam. Class 4 lasers and laser systems are also capable of causing severe skin damage and igniting flammable and combustible materials.

General Laser Safety Recommendations And Requirements

1. Never look directly into the laser light source or at scattered laser light from any reflective surface. Never sight down the beam into the source.
2. As a precaution against accidental exposure to the output beam or its reflection, those using the system should wear laser safety glasses as required by the wavelength being generated.
3. Use the laser in an enclosed room. Laser light will remain collimated over long distances and therefore presents a potential hazard if not confined.
4. Post warning signs in the area of the laser beam to alert those present.
5. Advise all those using the laser of these precautions. It is good practice to operate the laser in a room with controlled and restricted access.

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