

# Class 4 Laser Laboratory Requirements

The purpose of this document is to aid Project Designers and Principal Investigators in the design and construction of Class 4 laser laboratories. These guidelines comply with all requirements specified in the 2007 edition of ANSI Z136.1, **American National Standard for Safe Use of Lasers**.

The final design for Class 4 laser laboratories at Carnegie Mellon University will be determined through a review of proposed laser usage involving the responsible Principal Investigator (PI), the Project Manager and the Carnegie Mellon University Laser Safety Officer (LSO), who resides in the Carnegie Mellon University Department of Environmental Health and Safety. The LSO will need to approve final design.

In some cases, laser lab design determined by the LSO and PI will deviate from this specification to achieve the best mix of safety and flexibility/efficiency for the principal investigator. For this reason, it is strongly recommended that laser design discussions be held early in the design process with participation from the Principal investigator, the Project Manager and the Carnegie Mellon University Laser Safety Officer (LSO).

Please contact the Carnegie Mellon University Laser Safety Officer, Andrew Lawson, at (412)268-8405 for any questions regarding these guidelines.

## Signage

Entryways into the laser usage area shall have signs that alert personnel to the type(s) of laser(s) that may be encountered within that particular lab. A list of authorized users and emergency contact numbers should also be provided on this sign. This is typically a laminated sheet attached to the door. In addition, an ANSI compliant illuminated laser warning sign (**Figures 1 and 2**) shall be mounted above the entryway to the lab and shall be illuminated whenever the laser is energized and capable of producing a beam. This sign contains the following warning:

DANGER  
Visible and/or Invisible Laser Radiation  
Avoid Eye or Skin Exposure  
To Direct or Scattered Radiation  
Eye Protection Required  
Class 4

**Figure 1-Illuminated Laser Signs**



**Figure 2-Preferred Type**



**\*\*Please contact the Carnegie Mellon University Laser Safety Officer for details on the preferred equipment.**

### Controlled Entry

The door to the laboratory shall be equipped with a self-closing device and be secured at all times. The door may be locked with a standard keyed lock, but a cipher lock with key override (**Figure 3**) is preferred so that the code may be easily changed as necessary. Key override is provided for custodial services or emergency access. See photo example.

**Figure 3-Cipher Lock with Key Override**



### Laser Beam Containment Curtain

Immediately inside the entrance to the lab, a laser beam containment curtain (**Figure 4**) shall be hung on a track with rollers which, when closed, fully protects the doorway from stray beams that might otherwise be reflected out the door. The curtain attaches to the walls by a Velcro strip. The curtain material must be nonflammable and capable of stopping laser radiation from the ultraviolet to the infrared and comply with ANSI: Z136.1- Section 7.5. An overlap of ~ 12 inches of two vertical curtain pieces shall provide access for persons desiring to enter the laser usage area.

If the curtain is parted wide enough, however, (e.g. for equipment access) an interlock (**Figures 5 and 6**) sewn into the curtain shall activate and the laser(s) will be de-energized.

Refer to the next section for a description of the interlock and shut-down circuit.

**Figure 4- Laser Containment  
Curtain on Track**



**Figure 5-Pull-Apart Interlock  
Switch**



**Figure 6-Interlock Shown  
Installed on Curtain**



## Control Circuit

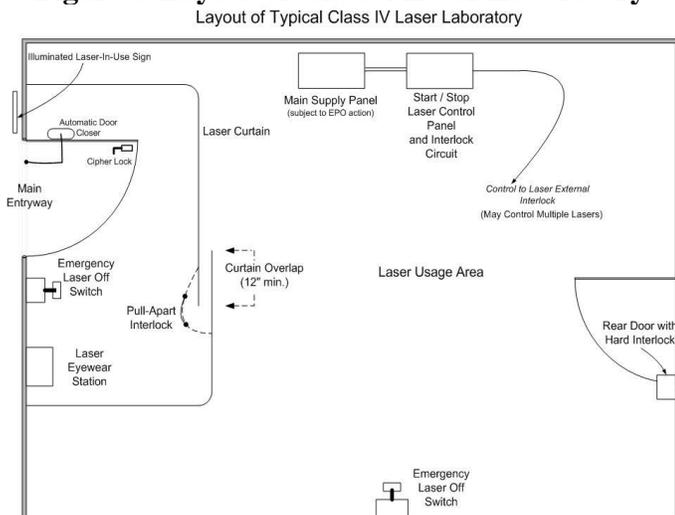
An electrical control circuit shall be installed in the laboratory for the primary purpose of shutting down laser operation in the event that one or more of the following occurs:

- Curtain interlock opened
- Door interlock opened
- An emergency "laser off" switch activated
- "Stop" switch activated
- Power lost to control circuit

## Laboratory Layout

The line drawing (**Figure 7**) shows a typical class 4 laser laboratory. Entry into the lab is gained via coded cipher lock. An illuminated sign visible outside the main lab entry would be lit if a laser were in use inside the lab. "In use" means that the laser has power to its power supply and is capable of producing a beam. A self-closing apparatus will close the door behind the user entering the lab. Appropriate laser safety goggles are selected at this point from the eyewear station (**Figure 8**) located inside the protected entryway.

**Figure 7-Layout of Class 4 Laser Laboratory**



**Figure 8-Eyewear Station**



An emergency laser beam off switch (**Figure 9**) is located just inside the door, as shown, and is available to emergency responders to cease laser beam operation before entry. A second laser stop switch may be located in the laser usage area and be available to lab occupants.

**Figure 9-Emergency Laser & Power Kill Mushroom type buttons**



The curtain is parted and the user may enter the laser usage area via the curtain overlap without breaking the pull-apart interlock. A secondary exit may be equipped with a "hard interlock" as shown in **Figure 7**. This switch action will cease laser operation when the door is opened and cannot be defeated. Within the lab are located the start/stop controls for the laser power supply which are wired similar to the supplied schematic. Refer to the circuit description in the previous section. Window panels in doors should be covered or replaced with an opaque material. In general, windows in the laboratory are covered both for light level control and to contain stray beams so that they are not reflected outside. All class 4 laser labs should be equipped with smoke detectors, sprinkler heads, and fire alarm annunciators. Gases required for excimer lasers may require gas cabinets with adequate exhaust and an exhaust monitoring device, additional sprinkler heads, and a gas detection system wired for fail-safe shutdown. Contact the Laser Safety Officer for specific details of these controls.

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