California State University, Fullerton Environmental Health & Safety
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Laser Standard Operating Procedure (SOP)

Introduction:

All Authorized Principal Laser Operators (APLO) and laser users are required to use this document to develop an SOP for the use of Class 3B and/or Class 4 lasers. The SOP will detail alignment, operation and maintenance procedures for each laser. Site and/or procedure specific non-beam hazards and their appropriate controls should be noted.

Instructions:

- Use this template to create a standard operating procedure (SOP) for each setup involving Class 3B and/ or Class 4 lasers. Use it for activities outside of standard operation for fixed/permanent laser systems as well.
  NOTE: All laser users, including visitors, must be briefed on proper safety protocols and must wear appropriate laser protective eyewear located on the premises. Authorized personnel shall escort them at all times.

- Authorized Principal Laser Operators, or delegate(s), shall train all laser users on this laser SOP and ensure it is followed each time the laser is used. This SOP is an important component of any operational on-the-job training.

- Each laser user that has been trained on this procedure shall sign the "Laser User Acknowledgement," on page 8.

- Place SOP in a conspicuous location near the laser/laser system, and ensure it is readily available to the APLO, laser user(s), and the Laser Safety Officer.

- This SOP shall be available for review upon request by the Laser Safety Officer.

Section A: Laser Registrant

Authorized Principal Laser Operator:		Laser System Location: (Department/Room/Bldg.)	
APLO Office Phone Number & Email:			
Laser Operator(s): (Check all that apply)	☐ Paid Staff/Faculty ☐ Enrolled Student(s) ☐ Volunteer Employees ☐ Visitors		

Section B: Laser System Information

Laser Model Number:		Laser Serial Number:		
Laser Classification: (Check one)	☐ **Class 3B** (5-500mW) or (≤ 125 mJ pulsed) ☐ **Class 4** (> 500mW) or (>125 mJ pulsed)			
Active Medium: (i.e., Argon, Ruby, Nd:YAG, Diode)				
Laser Wavelength: (nanometers)				
Laser Beam Divergence: (mrad)				
Laser Beam Diameter: (mm)				
☐ Continuous Wave	Average Power (W):		Maximum Power (W):	
☐ Repetitively Pulsed	Energy per Pulse (J):		Pulse Repetition Frequency (Hz):	
☐ Single Pulse	Pulse Duration (sec):		Pulse Width (s):	
☐ Q-Switched	Peak Pulse Power (W):		Peak Power Density (W/cm^2):	

Section C: Laser Preparation

(Ensure the steps below are followed during laser and/or laser system operations)

1) **Always** follow the Guidelines for Safe Laser Use (Appendix E of the CSUF Laser Safety Program).
2) Lock the room to prevent unauthorized access during laser operations.
3) Ensure the room has the appropriate warning signs for laser activities (see below).
4) Ensure the optical set-up is free of foreign objects.
5) Ensure required laser safety barriers or curtains are in place.
6) Ensure windows and doors are properly covered to prevent laser bean transmission.
7) Ensure the emergency egress from the Laser Control Area (LCA) is not obstructed.
8) Ensure all laser operations are performed in accordance with the APLO's instructions and the Laser Safety Program.

COMMENTS OR ADDITIONAL INFORMATION:

Section D: Laser System Operating Procedures

(Ensure the steps below are followed during laser or laser system operation)

1) **Always** follow the Guidelines for Safe Laser Use (Appendix E of the CSUF Laser Safety Program).
2) If required, ensure all personnel present are wearing protective eyewear (appropriate Optical Density for wavelength/power).
3) Ensure all jewelry which may reflect beams is removed.
4) Issue a verbal warning prior to starting the laser operation.
5) Ensure all laser operations are performed in accordance with the APLO's instructions and the Laser Safety Program.

COMMENTS OR ADDITIONAL INFORMAITON:

I. Entering Laser Room

(Specify below the engineering and/or administrative controls you have in place to protect against unauthorized personnel entering the laser control area)

II. **Setup**

(Explain in sufficient detail the process of setting up the laser operating system)

III. Start-up and Operation

(List the basic sequential events that describe the complete operation, including when to turn on the laser warning light, laser setting, etc. The procedures shall be written for the benefit of the laser user who must read and understand them to perform the operation safely)

IV. Shutdown

(Describe normal and emergency shutdown procedures)

Section E: Laser System Beam Alignment Procedures

(When performing beam alignment, follow all applicable safety measures listed below)

1) Exclude all unnecessary personnel from the LCA during alignment procedures.
2) If possible, use a low power alignment laser or use the lowest possible laser power setting.
3) Always wear the proper laser protective eyewear during alignment.
4) For aligning invisible (IR, UV) beams, use beam display devices (i.e., image converter viewers or phosphor cards to locate beams.
5) Use a shutter or beam block to block the high power beams except when actually needed for alignment.
6) Use a laser rated beam block to terminate high power beams downstream of the optics.
7) Locate and block all specular reflections as close to the source as possible.
8) Ensure all beams and specular reflections are terminated before high power operation.
9) Only trained laser operators are permitted to perform laser alignments.
10) **Include below the specific beam alignment instructions, including PPE to be worn and any applicable signs to be used.**
11) Ensure all laser operations are performed in accordance with the APLO's instructions and the Laser Safety Program.

COMMENTS OR ADDITIONAL INFORMATION:

Section F: Laser Protective Eyewear

For enclosed beams, all personnel utilizing a Class 3B and/or Class 4 laser or laser system **MUST** wear laser protective eyewear. Inspect all eyewear periodically and ensure it is in good condition. Ensure eyewear with the correct Optical Density (OD) and wavelength is provided to all laser operators and individuals in the Laser Control Area during open beam operation. Appropriate wavelengths and optical density can be confirmed on the LIA website: https://www.lia.org./evaluator/od.php

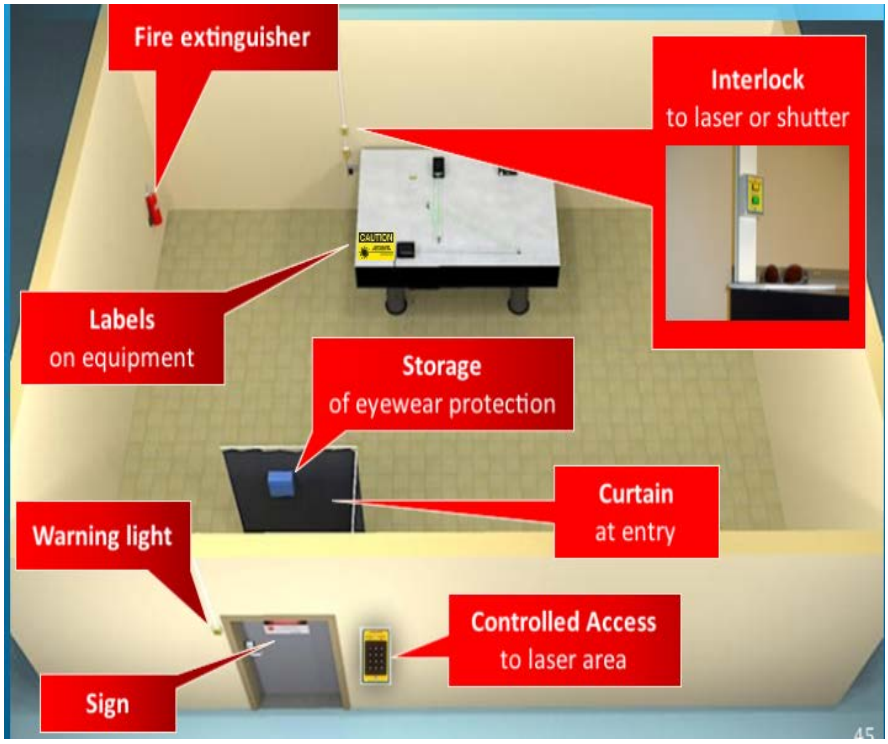
Eyewear Manufacturer	Eyewear Model	Rated Wavelength (nm)	Optical Density (OD)
Newport Optics	*G3982*	*770-810*	*5+*

COMMENTS OR ADDITIONAL INFORMATION:

Section G: Diagram of Laser or Laser System Setup

(Show the location of beam stops, interlocks, shielding, mirrors, and other relevant details or attach drawing. Include laser location, beam path, emergency shutdown location(s), and fire extinguisher(s))

EXAMPLE DIAGRAM:



LASER/LASER SYSTEM DIAGRAM:

Section G: Beam Hazards		
Check if Present	**Beam Path Characteristics**	**Comments**
☐	Beam Path is Clearly Identified	
☐	Beam is Enclosed as Much as Possible	
☐	Beam is Not Directed Towards Hallways, Doors, Desk Areas, Traffic Areas, Laser Control Area Entry Points, or Windows	
☐	Beam is Terminated at the End of its Useful Path	
☐	Beam is Not Located at Sitting or Standing Eye Levels	
☐	Surfaces Scatter Radiation and Minimize Specular Reflections	
☐	Beam is Viewed Remotely	

Section H: Non-Beam Hazards		
Check if Present	**Non-Beam Hazards**	**Comments**
☐	Electrical Hazards	
☐	Collateral Radiation Hazards	
☐	Plasma Radiation Hazards	
☐	Noise Hazards	
☐	Glass or Nanoparticle Hazards	
☐	Laser Generated Air Contaminant Hazards	
☐	Laser Dye and Solvent Hazards	
☐	Cryogenic Liquid Hazards	
☐	Biological Agent Hazards	
☐	Trip Hazards	
☐	Fire Hazards	
☐	Other (Specify)	

Section I: Laser System Control Measures

(For each hazard present, check the hazard. Under 'Implemented Control Measures' indicate the attachment number which outlines the appropriate control measures)

Check if Present	Hazard	Comments
☐	Safety Interlocks are Present/Functioning Properly	
☐	The Protective Housing Interlock is Not Bypassed or Overridden During Laser Operation	
☐	An Emergency Stop Button, Key, or Coded Access Pad, is Available Which Will Terminate the Laser Beam Immediately (Class 3B & Class 4)	
☐	An Activation Warning System, a Remote Interlock Connector, and a Beam Stop or Attenuator are in Place and Functioning Properly (Class 4)	
☐	Laser is Securely Mounted on a Stable Platform	
☐	Laser System is Grounded	
☐	Nominal Hazard Zone (NHZ) Clearly Marked	
☐	Protective Barriers, Curtains	
☐	Windows Covered Where Applicable	
☐	No Reflective Surfaces Near Beam	
☐	Laser Warning Signage	
☐	Audible Warning System	
☐	Fire Extinguisher Available	
☐	Emergency Contact Information Located on Door Signage	
☐	Extra Safety Eyewear Available	
☐	Lit Sign Interlocked with Laser Power Supply	
☐	Lit Sign Controlled by Switch	
☐	Mounted Reversible Sign: **Green "Laser OFF," Safe To Enter; Red "Laser ON," Do Not Enter**	
☐	Other (Specify)	

Section J: Laser System Maintenance

Appropriate signage is required for maintenance activities. EHS will provide 'Laser Service in Progress' door placards upon request.

COMMENTS OR ADDITIONAL INFORMATION:

Section K: In Case of Emergency

(Laser accident reporting requirements may be found in Section VI, Part 10 of the CSUF Laser Safety Program)

Laser Safety Officer:	**Leo Lopez**	**Phone:**	**(657) 278-4429**
E-Mail:	**LLopez@fullerton.edu**		
Medical Emergencies and Fire:	**CSUF Police Department**	**Phone:**	**Emergency: 911** **Non-Emergency: (657) 278-2515**

Note: If 911 is dialed from a cell phone while on campus grounds or from a campus phone, you will automatically connect to the CSUF Police Department.

1) Shut the laser off immediately and remove the interlock key. If not possible, alert everyone to exit the room.

2) If there is a fire or medical emergency, call the CSUF Police Department (911) as necessary.
   - Laser induced medical emergencies include severe injuries from beam exposure such as suspected eye exposure, vision loss, bleeding from the eye, and burns to areas around the eyes and/or on the face.

3) **Do not alter the laser setup. It is important to analyze the setup as it existed at the time of injury so we can help find the cause of accident and develop corrective actions to prevent a recurrence.**

4) Notify the Authorized Laser Operator and the Laser Safety Officer immediately.

COMMENTS OR ADDITIONAL INFORMATION:

Section L: Laser User Acknowledgement

I certify that I have read and understood this Standard Operating Procedure and its contents. I agree to comply with these procedures each time I use the laser and/or laser operating system specified in this SOP.

NOTE: All individuals listed below affirm that they have read and agreed to comply with the attached SOP.

Name (Last, First)	E-Mail (CSUF)	PI/Supervisor	Signature	Date

Section M: Standard Operating Procedure Approvals

These Standard Operating Procedures have been reviewed and approved by the APLO and LSO. Future changes to this SOP must be submitted, reviewed, and approved by the LSO.

_____ _____

Signature of Authorized Principal Laser Operator (APLO) Date

_____ _____

Approval Signature of Laser Safety Officer Date