**Scope**

This section explains the laser safety rules and procedures we follow to protect everyone and prevent accidents while using laser equipment.Our goal is to provide a safe working environment consistent with our policy, which is guided by ANSI Z136.1(2022) 1, the American National Standard Institute on the Safe Use of Lasers.

Our Laser Safety Officer(s) is/are responsible for managing the laser safety program. The Laser Safety Officer (LSO) checks safety controls for laser hazards and takes action to reduce risks, including stopping or limiting laser use if needed.

The current authorized laser welding/cleaning personnel are:

**1.**

**2.**

**3.**

**4.**

**5.**

If laser operators want to make recommendations for any processes, you must write them down and submit to LSO for review.

**Alternate Control Measures**

If the LSO approves, the safety controls in this document can be replaced with others that offer the same or better protection. If different controls are implemented, users, supervisors and management must get proper laser safety and re-training. These changes must also be written into an updated procedure in all related documents (checklists, JHA, APP).

Responsibilities of Laser Safety Officer (LSO)

* Program development and implementation following Manufacturer User Manual guidelines, [WAC 296-620-09005](https://lni.wa.gov/safety-health/safety-rules/chapter-pdfs/WAC296-62.pdf), ANSI Z136.1(2022) and any other relevant information.
* Approve instructions for standard operations, laser alignment, and other tasks that need to follow safety and control rules
* Conduct Hazard Evaluations for Class 4 laser (see separate Laser JHA document)
* Classify constructed or modified lasers and laser systems
* Provide laser safety training and maintain a list of authorized users.
* Provide ANSI Z136.1(2022) approved warning signs and labels . Also see [WAC 296-62-09005](https://app.leg.wa.gov/WAC/default.aspx?cite=296-62-09005), section 4b.
* Periodically audit laser use facilities
* Investigate laser accidents
* Keep a list of all Class 4 lasers and laser systems, and make sure each one has a distinct number so that systems are properly identified.

This Standard Operating Procedure (SOP) explains what authorized users of Class 4 lasers need to follow. It also describes how the laser is normally used and what dangers to watch out for during normal operation. The SOP will explain how to minimize any hazards and how to respond in an emergency.

This document shall be reviewed annually by the LSO, starting from the date of initial approval. In addition to the annual review, the LSO must evaluate and incorporate any updates issued by OSHA or WAC, as well as any internally generated documentation prompted by specific conditions. These conditions include, but are not limited to:

* Workplace accidents
* Near-miss incidents
* Modifications to equipment, procedures, or facilities
* Any other significant process changes

The review must occur upon the earliest of these events.

**Hazards**

A Class 4 laser can cause severe eye damage (including blindness) and skin damage can result from direct beam and specular reflections. See **Attachment A** at the end of this document.

* Only authorized personnel will operate lasers.
* There will be a specific Laser Control Area (LCA) in the shop which will have a protective curtain or entry door to room which will house the laser equipment.
* When the Class 4 Laser is in operation the protective curtain or door will be closed and locked, and a signal light(s) will be activated.
* Unauthorized personnel will be only allowed entry during laser operation with proper PPE and supervision of the authorized user.
* Laser eye protection (LEP) for sufficient protection against 1070nm is available and is in the drawer of the machine stand. You must wear laser safety glasses during beam adjustments, or anytime an open laser beam is stronger than the safe limit. *Note that Class 4 laser eye protection is wavelength specific at 1070nm. Locate the 1070nm designation on the glasses to confirm you are using the correct type.* See **Attachment A** for a complete list of PPE requirements.
* Reflections from the laser will be controlled using beam stops, barriers, housings, and enclosures.

| **Type of Reflection** | **Surface** | **Danger Level** | **Beam Direction** | **Safety Concern** |
| --- | --- | --- | --- | --- |
| **Specular** | Smooth, shiny | **Very High** | Predictable but powerful | Eye/skin injury, fire |
| **Diffused** | Matte, rough | Moderate-High | Scattered | Skin burns, indirect exposure |

* Remove jewelry or other reflective materials, especially on the hands and neck.
* User should avoid bending over or otherwise putting their eyes at the level of the beam path while the laser is in operation. The red beam is the indicator of where the invisible beam is located.
* If the beam path must be changed significantly by relocating the laser or optics, all coworkers in the area must be notified to wear laser grade PPE or moved to as safer area while the laser is emitting a beam.
* Use the same safety precautions for adjusting the laser’s optics as you do when operating the laser, such as going from Welding mode to Cleaning mode. See **Attachment A** for those precautions.
* When there is a change of users of the machine, current user must follow shutdown procedures and the new user must initiate new start up processed.
* **Use of this laser on stainless or aluminum generates toxic fumes and exhaust ventilation, or fume extraction is required. Make sure this is available when working with these types of material. Refer to** [**Airborne Contaminants, WAC Chapter 296-841,**](https://www.lni.wa.gov/safety-health/safety-rules/chapter-pdfs/WAC296-841.pdf)  **and** [**General Occupational Health Standards, WAC Chapter 296-62-08003 Hexa**](https://www.lni.wa.gov/safety-health/safety-rules/chapter-pdfs/WAC296-62.pdf#WAC_296_62_08003) **Chromium**

**Emergency Procedures**

In the event of a laser accident:

* Hit the red Emergency Stop Button shutting the laser fully off.
	+ Ensure the safety of personnel (first aid, evacuation, etc.) as needed.
	Get medical help for anyone who may be injured. 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. *Note — If an eye injury is suspected have the injured person keep his/her head upright and still to reduce bleeding in the eye.*
	+ **Also review personnel for any burns**
* If there is a fire, call 911. Do not fight the fire unless it is very small, and you have been trained in fire extinguisher use techniques. See **Attachment A** at the end of this document.
* Inform your supervisor and Laser Safety Officer as soon as possible.
* Follow our standard Accident Investigation per your company’s APP. Do not alter the laser setup. It is important to analyze the setup as it existed at the time of injury to help find the cause of accident and develop corrective actions to prevent a recurrence.
* Do not resume use of the laser system until the Class 4 Laser has been inspected by the LSO and approved before the resumption of work.

**Power outage**

If there is a power outage during Class 4 Laser use, turn off the laser to avoid the possibility of activation when power is restored. Once power is back on start at the beginning as when you began the project. See **Attachment A** starting at the beginning to make sure all is good before you continue.

**Laser System Maintenance**

Maintenance will only be performed by a qualified manufacture representative. **Work involving access to the power supply will require standard LOTO procedures.**

Appropriate signage is required for maintenance activities. LSO or Safety Lead will provide ‘Laser Service in Progress’ door placards.

**See additional attachment at the end of this document:**

* **Attachment A - Per-Use Checklist**
* **Attachment B - Job Hazard Analysis (JHA)**
* **Attachment C - Annual Laser System Checklist**

**Laser User Acknowledgement**

I certify that I have read and understood this Standard Operating Procedure (SOP) and its contents. I agree to follow these procedures every time I use the laser or its operating system. Any future changes to this SOP must be submitted to, reviewed by, and approved by the LSO.

Signature of Authorized Laser Operator

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Printed Name of Authorized Laser Operator

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Attachment A – Per Use Checklist**

Inspected by:

Date:

Use this general self-inspection checklist every time the laser is operated.Report any out of normal issues to the LSO.

**Each Use Review**

|  |  |  |  |
| --- | --- | --- | --- |
| **Pre Check**  | **Yes** | **No** | **N/A** |
| Are all authorized users registered with the laser safety program and listed in the SOP? |  |  |  |
| Are all authorized users current with their training? |  |  |  |
| Have the operations and configuration of any authorized lasers changed in a significant manner (e.g., change in layout, configuration, wavelength, etc.)? |  |  |  |
| Are written instructions for using, fixing, and setting up the laser equipment kept with the machine? |  |  |  |
| **PPE** in good order: |  |  |  |
| Clothing – jacket, gloves,  |  |  |  |
| Glasses with correct UV rating - Optical Density 7 (OD7) or greater at a nominal laser wavelength of 1070 nm. |  |  |  |
| Welding Helmet with glass face Z87.1rating |  |  |  |
|  |  |  |  |
| **Equipment Inspection:** |  |  |  |
| Set up with proper tips/wire/ventilation for the type of material being welded  |  |  |  |
| Confirm machine settings to match material type and thickness |  |  |  |
| Gas – correct type and enough to complete task   |  |  |  |
| Emergency Stop button in released mode ready for use |  |  |  |
|  |  |  |  |
| **Postings and Communication** |  |  |  |
| Do Class 4 lasers have signs that say you need to wear eye protection to use them? |  |  |  |
| Is protective eyewear available and correct for wavelengths in use and marked with wavelength 1070NM and optical density OD7? |  |  |  |
| Are laser-controlled areas posted, and equipment labeled with approved signs and labels? |  |  |  |
| Is access to laser controlled to prevent people being accidentally exposed to the laser beams by posting or controlling the entrance? |  |  |  |
|  |  |  |  |
| **Safety Conditions** |  |  |  |
| Is an inspection covering the items listed below performed prior to each operation? |  |  |  |
| Are windows and ports, which could allow a laser beam to stray into uncontrolled areas covered or protected during laser operation? |  |  |  |
| Are barriers/screens (if present) non-combustible & no burn holes? |  |  |  |
| Is optical bench free of unnecessary reflective items? |  |  |  |
| Combustables removed from the area?  |  |  |  |
| Fire Extinguisher(s) on hand? |  |  |  |
| **Shut Down and Clean up** |  |  |  |
| Hand laser cleaned up and returned to ‘holster’ |  |  |  |
| Key turned off |  |  |  |
| Gas turned off |  |  |  |
| PPE Stored |  |  |  |
| Check area for any hot spots |  |  |  |
|  |  |  |  |
| **Have all laser accidents, incidents, or near misses been documented?** |  |  |  |
|  |  |  |  |

|  |
| --- |
| List any other safety deficiencies found |
|  |
| List corrective actions taken for any identified deficiencies |
|  |
| Other notes |

**Attachment B - Job Hazard Analysis (JHA): Class 4 Laser Welding**

# 1. General Information

Company Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
Location: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
Department: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
Date of Analysis: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
JHA Completed By: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
Reviewed By: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# 2. Job Title / Task

Job Title: Laser Welding Technician

Task: Operating a Class 4 Laser for welding applications.

# 3. Regulatory Reference

This JHA meets the requirements of Washington Administrative Code (WAC) 296-800-160: Personal Protective Equipment (PPE), and addresses hazard assessment and protective measures.

# 4. Job Steps, Hazards, and Controls

|  |  |  |
| --- | --- | --- |
| **Job Step** | **Potential Hazard** | **Recommended Controls / PPE** |
| Setup of Class 4 Laser System | Electrical shock, fire hazard, exposure to non-enclosed laser beam | Ensure laser is properly grounded; use key control system; conduct pre-use inspection; follow lockout/tagout if servicing. |
| Aligning Beam / Adjusting Optics | Direct or reflected laser exposure to eyes and skin | Use appropriate laser-rated eyewear; restrict access to controlled area; use beam stops and non-reflective tools. |
| Welding Operation | High-intensity light and heat, fire from flammable materials, inhalation of metal fumes | Wear laser-rated face shield, fire-retardant clothing, welding gloves; use local exhaust ventilation (LEV); remove combustibles, have fire extinguisher in work area. |
| Shutdown and Maintenance | Residual laser energy, electrical hazard, hot surfaces | Follow cool down procedures; lockout/tagout electrical components; wear thermal-resistant gloves. |

# 5. Required Personal Protective Equipment (PPE)

- Laser safety glasses (rated for laser wavelength)
- Face shield with laser rated window
- Fire-retardant lab coat or welding jacket
- Welding gloves (thermal and spark protection)

- Fire extinguisher(s)
- Hearing protection (if in noisy environment)
- Safety shoes with non-slip soles

# 6. Additional Notes / Comments

- All operators must be trained and authorized to use Class 4 lasers.

- Access to the laser area must be restricted, with warning signs and emergency protocols clearly posted.

**Attachment C - LSO Annual Laser Safety Self-Inspection Checklist**

LSO is responsible for ensuring that an annual inspection is conducted. The LSO must evaluate and incorporate any updates issued by OSHA or WAC, as well as any internally generated documentation prompted by specific conditions. These conditions include, but are not limited to:

* Workplace accidents
* Near-miss incidents
* Modifications to equipment, procedures, or facilities
* Any other significant process changes

The review will also occur upon the earliest of these events.

Inspected by:

Date:

**Annual Inspection Items**

|  |  |  |  |
| --- | --- | --- | --- |
| **Documentation & Training**  | **Yes** | **No** | **N/A** |
| Are all authorized users registered with the laser safety program and listed in the SOP? |  |  |  |
| Are all authorized users current with their training? |  |  |  |
| Have the lasers listed as authorized on the SOP been changed (Multiple Class 4 laser(s) added, or a laser removed from service, etc.)? |  |  |  |
| Have the operations and configuration of any authorized lasers changed in a significant manner (e.g., change in layout, configuration etc.)? |  |  |  |
| Are written instructions for using, fixing, and setting up the laser equipment kept with the machine? |  |  |  |
| Have all laser accidents, incidents, or near misses been documented? |  |  |  |
| **Postings and Communication** |  |  |  |
| Do Class 4 lasers have signs that say you need to wear eye protection to use them? |  |  |  |
| Is protective eyewear available and correct for wavelengths in use and marked with wavelength and optical density? |  |  |  |
| Are laser-controlled areas posted and equipment labeled with approved with legible signs and labels? |  |  |  |
| Is access to laser controlled to prevent persons being accidentally exposed to the laser beams by posting or controlling the entrance? |  |  |  |
| **Safety Conditions** |  |  |  |
| Are the protective housing/curtains in good condition, and have the interlocks been tested? If not, have other safety controls been reviewed by the Laser Safety Officer and included in the procedures? |  |  |  |
| Are barriers/curtains (if present) non-combustible & no burn holes? |  |  |  |
| Protective eyewear is appropriate for laser operation and is clean/ free of damage? |  |  |  |
| Are all wires, cables covered and circuits protected? Are the wires placed so no one can trip over them? |  |  |  |
| Is an inspection covering the items listed below performed prior to each operation? |  |  |  |
| Reflective items removed or covered? |  |  |  |
| Beam path enclosed where possible? |  |  |  |
| Optical bench free of unnecessary reflective items? |  |  |  |
| If beam crosses a walkway, are there posted barriers and signs placed across path during operation?  |  |  |  |
|  |  |  |  |
|  |  |  |  |

|  |
| --- |
| List any other safety deficiencies found |
|  |
| List corrective actions taken for any identified deficiencies |
|  |
| Other notes |