SOP LIGO M-01xxx-A-L 01/19/01

Standard Operating Procedure

LIGO 10W YAG Laser operating in
LLO X-end Optics Laboratory

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1 PURPOSE AND SCOPE

This Document is the Standard Operating Procedure (SOP) for the LIGO 10W Laser when it is operating in the Laser Controlled Area at the X-end station. It is designed to ensure the safety of all personnel and equipment in and around the area where LIGO 10W Laser is operating. Its role within the overall laser safety plan is described in LIGO M990148, LIGO Livingston Laser Safety Plan. This SOP contains the essential procedures required for the safe operation of the LIGO 10W laser in the X-end Optics Laboratory and is approved by both the LIGO Livingston Observatory (LLO) Laser Safety Officer and the LLO Site Safety Officer.

2 LABORATORY LAYOUT

The LIGO 10 Watt Laser is located in the Laser Controlled Area within the Optics Laboratory at the X-end. The laboratory layout is shown in Figure 1. The laser and ancillary optical components

Figure 1: Layout of Optics Laboratory Laser Controlled Area
mounted on the Optics Table. The designated Nominal Hazard Zone (NHZ) includes all of the area behind the laser safety curtain, the areas where the Optics Table is located as shown in Figure 1.

3 LASER DESCRIPTION

The LIGO 10W Laser is Class IV Nd3+:YAG laser. It is a model 220-1064-10000 laser system manufactured by Lightwave Electronics Corp. The output from this laser is in the near-infrared region of the electromagnetic spectrum and is therefore not visible to the human eye. The relevant operating parameters for the LIGO 1-W Laser are:

- 1064 nm wavelength
- 10W max. power output
- continuous wave output
- 300W/cm² intensity at output aperture (beam diameter approximately 2mm)

4 HAZARDS

A laser hazardous condition exists anytime the 10 W laser power is on and it is capable of emitting a beam. A Class IV laser is a hazard to the eye or skin from the direct beam, maybe a hazard from a diffuse reflection, and may also be a fire hazard. Infrared lasers such as the LIGO 10 W Laser pose an additional hazard because the output radiation is not visible to the unaided human eye.

5 CONTROLS

5.1. Access Controls

At the entrance to the Optics Laboratory Laser Control Area, outside the double entrance doors is located an illuminated Tri-Lume sign. A keyswitch on the sign energizes the electric Tri-Lume warning sign to the appropriate warning condition, as indicated by illuminated panel on the front of the sign.

- **NO HAZARD**/Laser Off - the laser power supply is unplugged.
- **CAUTION**/Laser Energized - the laser power supply is energized, but the aperture shutter of the laser is closed
- **DANGER**/Beams Accessable - the laser is operating and emitting a beam of laser light.

It is the responsibility of the “Responsible Laser Operator” operating the laser to visually check for proper operation if the Tri-Lume sign.

Wearing the appropriate laser safety eyewear is mandatory before opening the first laser safety curtain to enter the Laser Controlled Area when the Laser Safety Warning sign is illuminated.

The Laser Safety of the Laboratory also relies on:
• A number of physical barriers and beam dumps.
• Training.- Personnel must be a Registered Laser Personnel for this system to enter the Laser Controlled Area without an escort.
• Written, approved Standard Operating Procedures.
• A copy of this SOP, and a list of Registered Laser Personnel for this system is to be posted at the entrance to the Laser Control Area

The Laser Controlled Area is considered to be safe when the Laser Safety Warning sign is in the “NO HAZARD” position, indicating the power to the laser power supply has been unplugged

5.2. Electrical Controls

All control and monitoring functions for the LIGO 10 Watt Laser are accessed via the laser power supply located in the rack next to the optics table.

5.3. Eye Protection

Required protective eyewear for the LIGO 700mWatt Laser must have an optical density (OD) of greater than 5.0 for 1064 nm wavelength radiation.

6 OPERATING PROCEDURES

1. When the LIGO 10 W Laser is operating within the Laser Controlled Area the laser warning sign must be energized and all persons entering the Laser Controlled Area are required to wear eye protection as described in Section 4.5., above, before entering and at all times while working within the Laser Controlled Area (NHZ).
2. Before entering the Laser Controlled Area, each person must announce his or her intent to enter and await a reply from anyone already within the enclosure.
3. Any time one or more people will be working within the Laser Controlled Area or the laser will be running unattended, ONE person shall be designated the "Responsible Laser Operator.” The name of the Responsible Laser Operator shall be posted near the Laser Controlled Area laser warning sign.
4. The Responsible Laser Operator shall coordinate activities on or in the vicinity of the laser optical table. Multiple independent activities involving manipulation of the laser beams shall not occur simultaneously. Any time the laser beams will be manipulated, e.g. by inserting, removing, or adjusting optical components, persons not directly participating in the beam manipulation activity will move to a safe location until the activity is completed.
5. Before and during insertion or removal of any optical component, the power of all affected laser beams shall be reduced to it’s lowest working power setting. Any need to depart from working at the reduced power levels, requires a special written procedure to be approved in advanced by the LSO.
6. All persons manipulating the laser beams, e.g., by placing objects such as mirrors, lenses, power meters, or beam dumps, into or near the laser beam paths, must remove all jewelry such as wrist watches and rings.
7. Immediately after inserting, removing, or making significant adjustments to any optical component, the vicinity of the optical table shall be scanned with an infrared viewer or other suit-
able beam-finding device to ensure that all stray beams are dumped.
8. Scattering of laser light shall be kept to a minimum at all times by maintaining proper alignment of optics, utilization of beam dumps, and ensuring that optics are securely fastened.
9. Each time the laser will be left running unattended, the vicinity of the optical table shall be scanned for stray beams immediately prior to vacating the Laser Controlled Area. The "unattended" status of the laser shall be posted near the name of the Responsible Laser Operator at the entrance to the Laser Controlled Area.

It is the responsibility of each person working within the X-end Optics Lab Laser Control Area (NHZ) to ensure that LIGO standards for safe laser operation are being followed at all times.

APPENDIX 1  APPLICABLE DOCUMENTS


LIGO-M990152--x-L, *Procedure for Transition to the LASER HAZARD Condition*

LIGO-M990153--x-L, *Procedure for Transition to the LASER SAFE Condition*