

**Standard Operating Procedure**  
**- First Draft for Review Only -**  
**Lee Laser Nd: YAG - LDP-20MQG**

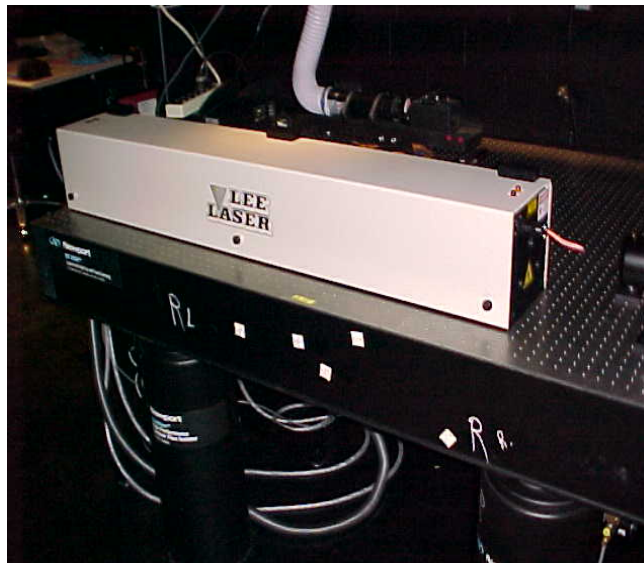
Generated by Dave Turnbull  
September 2, 2005.

**This SOP is intended only for the specific operation described below (Operation at 532 nm, Q-switched at 10kHz and changeover to 1064 and back). The operator must check that the laser was left in running condition before starting. For any other applications the operator is referred to the manual.**

**Report any omissions or changes in this SOP so corrections can be made.**

**Location:**

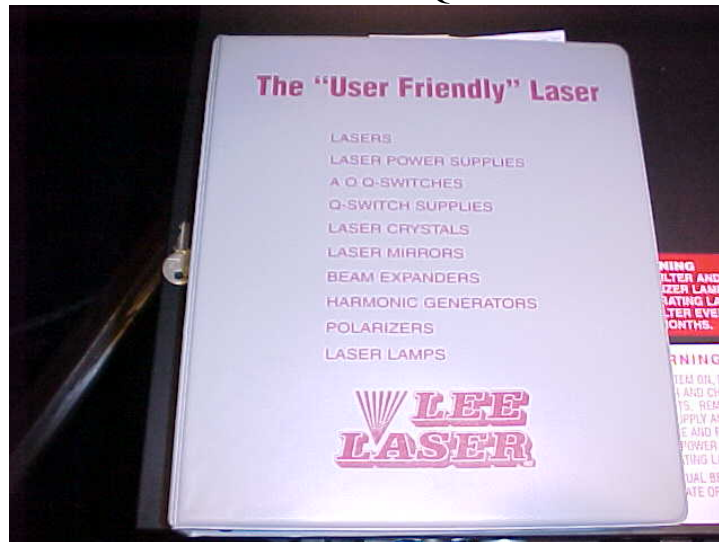
This laser is currently located in 15. The Advanced Optic Lab at Niagara College's Welland Campus.



## **Safety:**

This laser is a Class IV laser and operators are expected to be familiar with proper safety precautions before operating this laser. The operator is directed to the laser manual for a complete description and the Standard, ANSI Z136.1 (2000) Safe Use of Lasers.

Lee Laser LDP-20MQG Manual



**Eyewear must be worn at all times** that protects the operator and anyone else in the nominal hazard zone against radiation at 1064 nm and 532 nm with an optical density of at least 6.

Nd:YAG laser goggles



## Niagara College Emergency Internal Extension Numbers:

Security	6666
Nurse (9:00-4:30)	7635
Ambulance	9911 (Dial 9 outside line then 911)

## System Overview:

A new Nd:Yag laser from Lee Laser was received on 07-07-05

**LDP-20-MQG**, diode-pumped, Q-switched, Nd: YAG laser, which included:

- Refrigerated Chiller
- He:Ne pointing laser
- Laser power measurement system (LDM-50)
- Dust enclosure (interlocked)

The LDP-20MQG multimode, frequency doubled, Nd:Yag. The second harmonic generation (SHG) crystal is a durable LBO (lithium borate). The laser has capabilities for emission at 1064nm and 532 nm (1064 nm output beam emission is achieved by removal of the SHG assembly – the operator is referred to the manual for this procedure).

Wavelength	532 nm
Traverse mode	multimode
Beam Diameter, nominal	2.0 mm
Beam Divergence, nominal	<2mr
Polarization	linear

Q-Switched performance at 10KHz

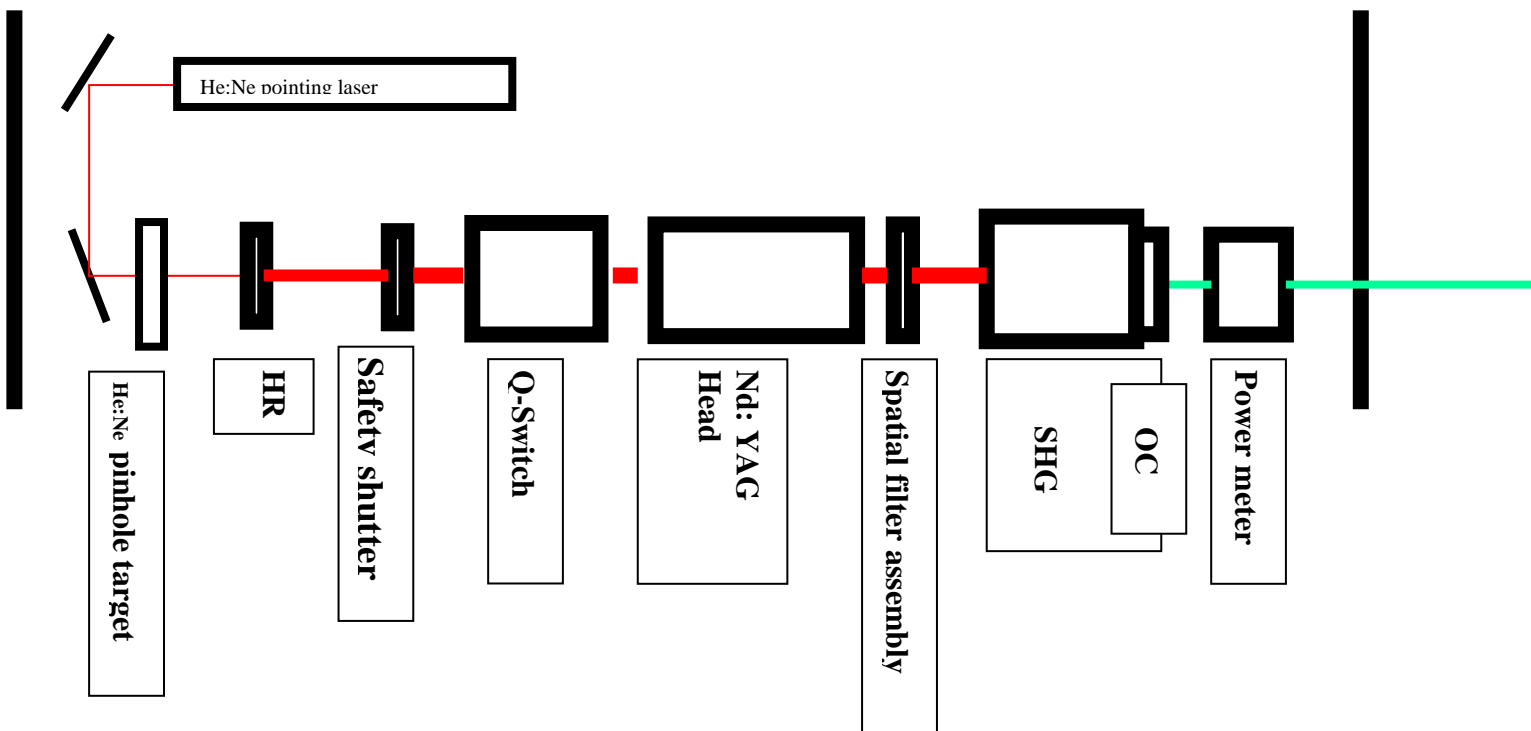
Average power	10W
Pulse width	250 ns
Peak Pulse Power	2.8 kW
Peak stability, peak-peak	5%

The system is set-up on an optical rail assembly, which is enclosed in an interlocked dust enclosure. The intracavity shutter will not open with cover dust enclosure open and the shutter will close if the cover is open while the laser is operating. There are also beam tubes installed between the optical components (see photo below).



The following figure outlines the component layout on the optical rail

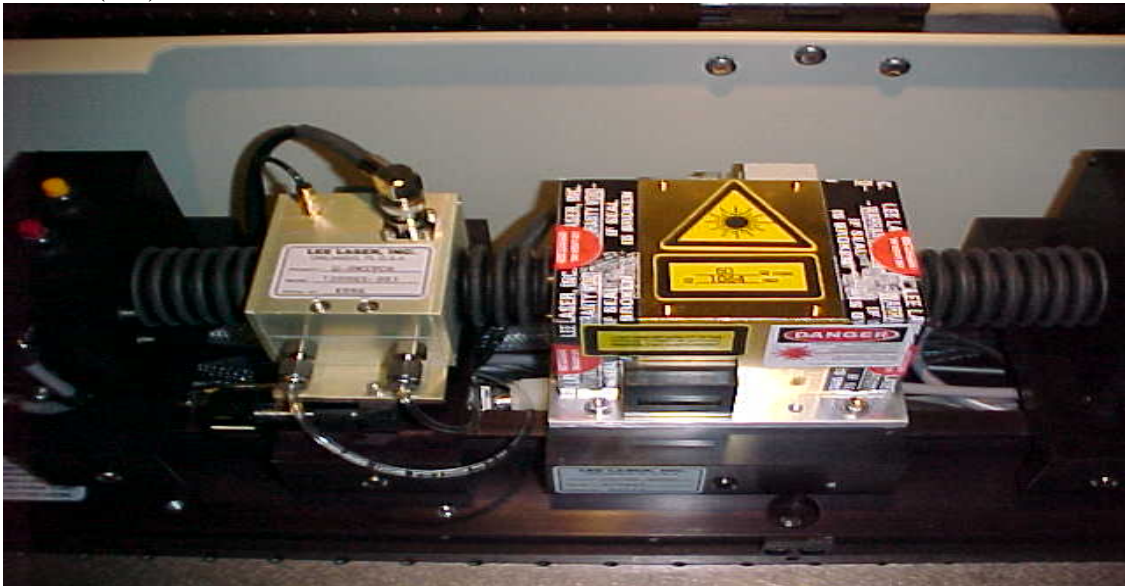
### Lee Laser LDP-20MQG



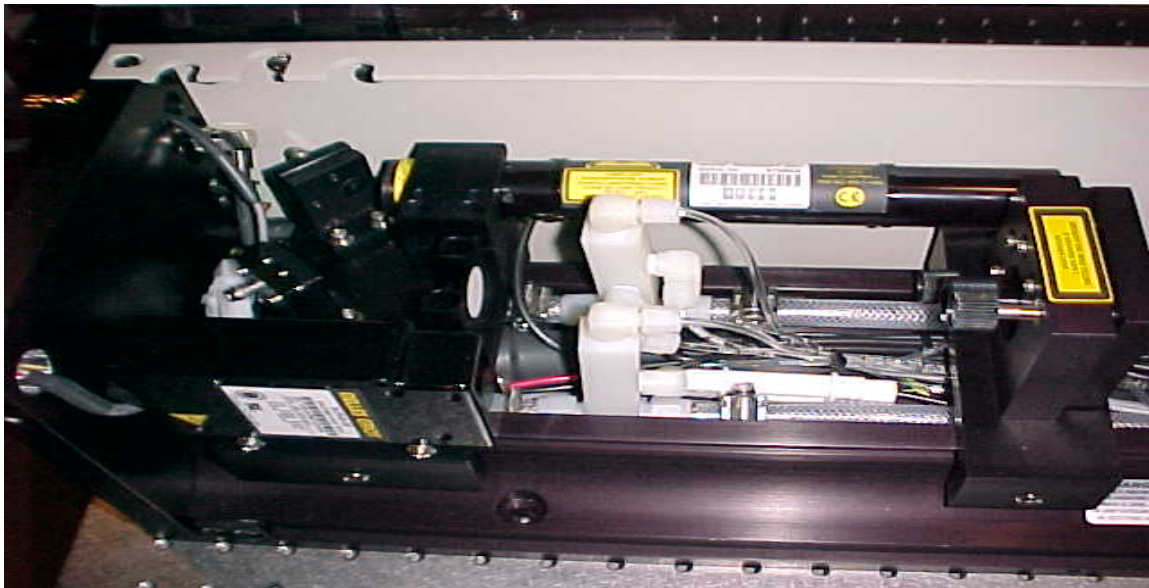
**Front Section: Power meter (right side), SHG (left) with OC (right end of SHG unit).**



**Mid-section : Diode pumped Nd:Yag (right), Acousto-optic Q-switch (middle), and shutter (left).**



**Back Section: HR (right), and HeNe laser and optics .**



### **Accessories:**

Output coupler for 1064 nm operation  
Set of spatial filters for TEM<sub>00</sub> Operation

### **Precautions:**

**Not recommended to operate Q-Switch below 5KHz – damage to crystal and AR coatings can occur.**

**Do not switch between free run and gauge on Q-Switch with shutter open and laser lasing – pulse could damage optics.**

**Do not engage the power meter without closing the shutter.**

## Start-up for Q-switched 532 nm operation:

The laser power supply with power meter and SHG temperature controller are shown below.



1. Sign-in on laser log sheet and check hours on power supply are in agreement with the last sign-in (This checks the condition the laser was left in) and report any discrepancies. Obtain the key for the power supply.
2. Make sure beams generated will be properly terminated. The He: Ne pointing laser can be used to aid in external beam alignments (see below for operation).
3. Before turning on any power the operator should make sure the following is set:

Key switch to the off position

**Power control turned to the full counterclockwise position** (minimum diode current)

Shutter set to the closed position.

Q-switch set to off position with modulation control set to external position

LDM-50 Power meter to off position.

Water level in Chiller above the minimum level indicated on the front panel.

3. Put on proper laser safety glasses – everyone in the nominal hazard zone must be wearing them.

4. Turn the CB-1 breaker on the rear panel to the on position. You should hear the cooling fan start on the power supply. If power does not start check circuit breakers outside door of V13A (positions 21 and 23) and additional breakers on rear panel (CB-2 to CB-7).

Turn main power key switch to the on position (this should illuminate the emission indicator and water flow interlock). Then turn this main power key momentarily to the pump start position until the pump starts then release the switch . The water flow indicator light should now be off. Check for any water leaks around the laser head and power supply and shut system down if found.



Allow system to operate for ~10 minutes to allow cooling water to stabilize.

5. Turn the power supply button to the on position (shutter must be closed for this to turn on). Current should read ~1 amp.

6. Turn the Q-switch driver and SHG temperature controller on.

Set Q-switch modulation control to internal operation and toggle switch to free run.

Set Q-switch driver meter scale to 50 kHz position and set dial to 10kHz.

7. Check SHG temperature controller is set to the correct temperature for 10Khz operation (at time of writing = 33.3°C)

**Power meter (top) and SHG Temperature controller**



8. Open the intracavity shutter.

The He: Ne pointing laser can be used at this time. To use the laser it must be plugged into 110V AC. The power cord is located on the back bulkhead of the laser. This pointing laser is turned on and off with the power cord.

9. Slowly increase the diode current to the desired level by turning the knob on the power supply clockwise.

**Laser should be lasing - if it is not shut the system down before any damage to SHG can occur.**

**Laser output is not stabilized – it will take ~20 minutes of system warm-up time.**

Check diode temperature by pushing button on the power supply by the diode current/temperature display and record on sign-in sheet

10. Power meter operation

The power meter located on the optical rail blocks the laser beam when in use. To operate close the laser shutter, turn the power meter on, and reopen the shutter. **Do not engage the power meter without first closing the shutter.**

### **Shut Down:**

1. Close shutter
2. Set power control knob back to idle power (full counterclockwise – minimum diode current)
3. Power supply off rocker switch to the off position.
4. Q-switch power off and modulation control to external.
5. **Wait 2-3 minutes then turn main key switch to off position.**
6. Turn SHG controller switch and power meter key off.
7. Unplug 110V He:Ne power cord.
8. Turn off the CB-1 breaker if unit is not going to be used in the near future.
9. Record final hours on sign-in sheet and remove and return key.

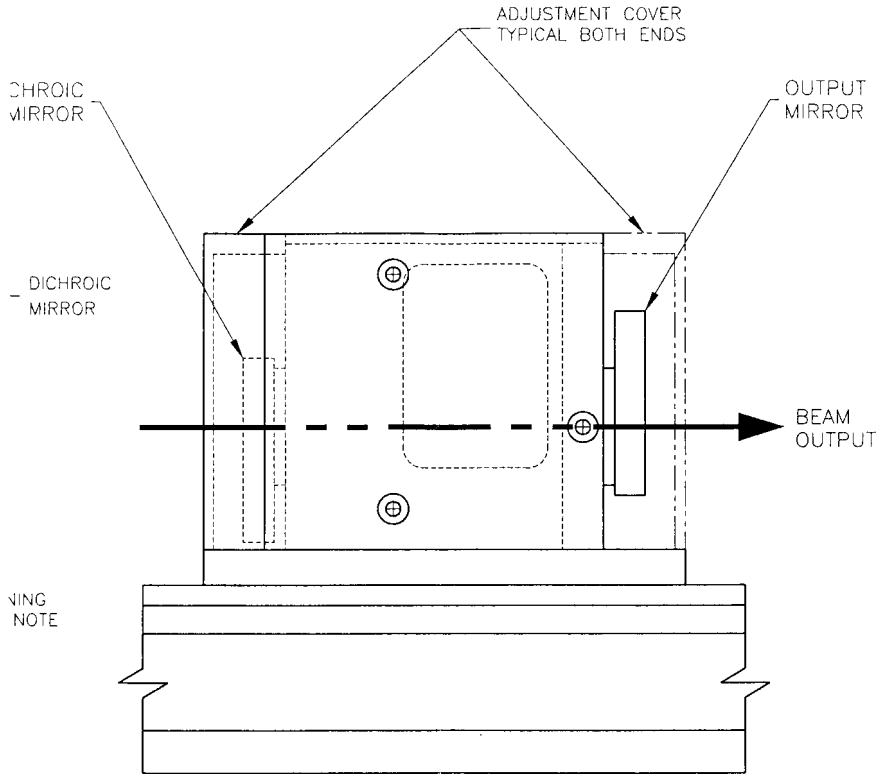
### **Changing between 532 nm and 1064 nm:**

1. **Laser power station in a totally off position.**
2. Open laser optical assembly dust cover. Pull both interlock switches up to defeat cover interlock.
3. Remove rubber dust hose from either side of SHG assembly.
4. Remove SHG assembly from optical rail (4 hex screws attach it into the rail – two at the front and two at the back of SHG assembly. The two screws at the front are accessed by removing the front adjustment cover). Use dust cover caps to cover openings to exposed optical elements. Disconnect the cooling water hose for the SHG and reconnect the laser cavity ends together (connect SHG cooling water ends together as well to prevent leakage and minimize contamination). **Store SHG assembly in a safe, clean location.**
5. Remove side cover on the power supply (left side when facing the front) and locate the 532/1064 nm switch on the back of the Q-switch driver. Change switch from 532 nm to 1064 nm position.
6. Install the 1064 nm output coupler 11 inches from the centre of the head (see optical layout above, “Nd:YAG Head”) and the install the front target (FT) just after the OC (in-between the OC and power meter).
7. Turn on the HeNe alignment laser. The beam should pass through the RT and FT. If not refer to the manual p. 6-9 for HeNe alignment. **Remove FT**
9. Check that the beam from the HeNe laser that reflects back into the cavity from the OC passes back through the RT. If not make Horizontal and Vertical adjustments to the OC to achieve this. **(Note: The next steps have changed from the manual as per instruction from Steve Lendway Lee laser 02-28-06. Lee recommends that no changes be made to the HR as this will preserve SHG the alignment and protect the LBO crystal.).** The HR should be kept as a reference and no adjustments made to it.

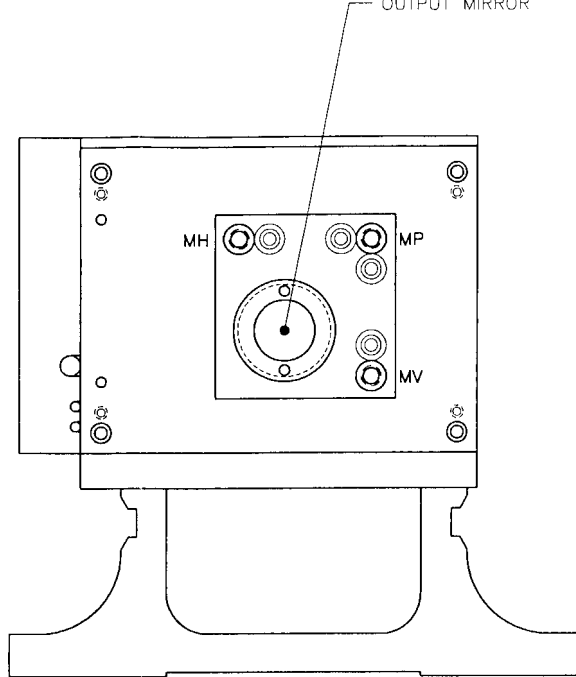
10. Start the laser as described above. Slowly increasing the diode current check for lasing action. If lasing, check the power at 20A diode current. The original specification for this was 21.4 W with a 10kHz Q-switch. If close to this power is not met small adjustments can be made to the OC vertical and horizontal adjustments. If a power close to the specified power is still not met, try cleaning the OC (**Do not attempt optic cleaning if not trained**). If specified power is not met at this stage do not proceed without input from a qualified person.

### **Changing Between 1064-532 nm:**

1. **Laser power station in a totally off position.** Steps are an intuitive reversal of the 532-1064 nm procedure described above and should be referred to for details.
2. Remove OC and reinstall SHG assembly (electrical and cooling connections to be made). This assembly aligns onto dowel pins.
3. Change switch on rear of Q-switch driver to 532 nm.
4. Start laser with diode current at lowest setting as described above. Open shutter and slowly increase diode current and check for lasing.
5. If lasing is below performance data, adjustments to the 532 nm output coupler vertical and horizontal adjustments can be made. **Do not adjust the mirror Pivot (see drawing from manual below).**
6. If power output is still below specified values contact a qualified individual for help.



REV	DESCRIPTION	DATE	ECN
1	NEW RELEASE	110-28-20741	JCH



NECESSARY.

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PART LIST

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