MAINTENANCE

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1.0 ROUTINE INSPECTION:

The most important aspect of maintenance is simple prevention. Routine periodic inspection of the laser system and the surroundings will help to ensure trouble free operation. The laser system should be installed and operated in an environment as clean and uncontaminated as possible. Installation facility requirements must be met and maintained. Smoking in the proximity to the laser system should be avoided. Routine inspection of the laser system should include visual checks for dust, dirt, and contaminations; checks for cooling water leaks and adequate cooling water levels; and periodic measurements of the laser output power levels.

2.0 PERIODIC MAINTENANCE:

In addition to routine inspection of the system, periodic inspection and maintenance of optical components and critical subassemblies should be established on a regular schedule.

- The focusing objective lenses should be inspected weekly and cleaned or replaced as required.
- The beam delivery optics should be inspected monthly and cleaned or replaced as required.
- The laser rail and beam delivery assembly should be checked for cleanliness, alignment, and mounting rigidity monthly.
- Cooling water, air, gas, and vacuum lines should be checked for leaks, contamination, and integrity monthly.
- Motor drive belts should be checked for wear, slippage, and tension semi-annually.
- Optical alignment must be performed as required, depending on use.
- The laser and power supply should be maintained according to the information provided in this manual.

3.0 RECORD-KEEPING:

It is strongly recommended that a regular record be kept of laser power output levels, control unit settings, cooling temperatures, and operating parameters. With accurate records, performance parameters and possible causes of failure can often be immediately pinpointed.

4.0 CORRECTIVE MAINTENANCE:

Where relevant, procedures for electrical and optical alignments are provided throughout this manual. Sufficient documentation and information is provided to guide an experienced technician through identification and corrective maintenance procedures. Detailed information regarding specific subassemblies has been provided in the manufacturer's operating manuals and should be consulted before attempting

corrective maintenance or service. It is recommended that the customer contact U. S. Laser Corporation for technical assistance whenever necessary.

4.1 ALIGNMENT EQUIPMENT:

For alignment maintenance, certain test equipment is essential, and is available from U. S. Laser Corporation. As a minimum, an autocollimator, a power meter, and an I.R. viewer are invaluable. For beam delivery alignment and target focus coincidence adjustments, alignment apertures and the focus coincident kit are valuable time savers. Consult the spare parts list contained in this manual, or call U. S. Laser for assistance.

5.0 OPTICS MAINTENANCE:

All laser optical components and surfaces should be meticulously maintained; however, in a fairly clean environment, over-ambitious maintenance of optical components may do more harm than good. Routine maintenance of beam delivery and focusing assemblies should be confined to gentle removal of dust or contaminants from laser assemblies with a soft brush or damp tissue, and from optical components with a jet of clean dry air - a bulb puffer is ideal. The aim is to remove dust without stirring it up. To keep contamination to the lowest level possible:

a. Keep optical rail covers closed whenever possible.
b. Avoid smoking in vicinity.
c. Protect the system from any dust producing activity.

The laser cavity mirrors; and, if equipped with any delivery optics, the upcollimator lens, the dichroic beamsplitter, the focusing objectives, etc. should be checked for cleanliness each month and cleaned as required.

The outer surface of the objective lens should be checked at each shift for surface contamination and cleaned or dusted as required. If the focusing barrel includes a lens protector slide, the slide should be checked frequently for debris and cleaned or replaced as necessary.

Solvents should be used only when contamination does not respond to routine maintenance. Refer to the U. S. Laser Optics Cleaning Manual for more detailed optics cleaning and maintenance procedures.

6.0 LASER HEAD AND LAMP CHANGE:

Refer to the manual section on Laser Head Maintenance.

6.1.0 PUMP LAMP:

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C A U T I O N ! ! !

BEFORE CHANGING A LASER PUMP LAMP, BE SURE THAT THE POWER SUPPLY HAS BEEN DE-ENERGIZED FOR AT LEAST 10 MINUTES TO ENSURE THAT IT IS FULLY DISCHARGED.

6.1.1 C.W. LASERS:

The laser pump lamp is a water cooled Krypton arc lamp. The average life of these lamps is 200 to 400 hours. To get the maximum service, operate the lamp nominally at currents less than 18 Amps for Model 403C and 403L lasers; less than 38 Amps for Model 403, 403T, 404, and 405 lasers; and less than 45 Amps for Model 406 and 408 lasers; and avoid frequent turn on and turn off. It is better for the lamp, to idle the system for an hour, than to turn it off and restart.

As the lamp ages, the current may be increased to maintain the laser output power. However, operation above 22 Amps for Model 403C and 403L lasers; 40 Amps for Model 403, 403T, and 404 lasers; 45 Amps for Model 405 lasers; and 50 Amps for Model 406 and 408 lasers is not recommended. When the lamp has deteriorated to the point of insufficient laser performance, the lamp must be replaced.

6.1.2 PULSED LASER:

The laser pump lamp is a water cooled Krypton/Zenon arc lamp. Typical lamp life is several million shots. Lamp life is a function of energy per shot, number of times the lamp is started and hours of "lamp lit". There are three basic failure modes of the laser pump lamp:

The first failure mode is lack of ability to properly pump the laser rod. This condition occurs due to normal lamp aging and typically coincides with a blackening of the lamp envelope, or an accumulation of white deposits on the inside of the lamp envelope. When the lamp can no longer adequately pump the laser rod, it must be replaced.

The second mode of failure is lamp fracturing. This condition usually occurs in an old lamp, which is nearing the end of its useful life. The deposits that collect on the inside of the glass envelope absorb the light and create local hot spots which fracture the glass. Thorough cleaning of the laser head cooling passages must be performed after all cases of lamp fracturing. Glass particles lodged in the cooling system will impede the cooling water flow and lead to premature lamp failure in the future.

The third failure mode is the inability of the lamp to support the simmer mode. That is, the lamp will not start or it will start but not stay lit. In this case, the lamp cannot be fired, and must be replaced.

Note: the touch screen will display a lamp failed message for failure modes two and three.

6.1.3 Refer to the Laser Head Maintenance Manual Section for lamp replacement procedure. Refer to the Recommended Spare Parts List for the proper lamp for this laser system.

6.2 LAMP FLOW TUBES:

The glass tube surrounding the laser lamp provides several crucial functions. Primarily this tube guides the water flow over the lamp providing proper pressure and flow velocity.

Secondly, this tube converts certain useless lamp emissions into useful pump band radiation. Thirdly, this tube blocks u.v. lamp light from deteriorating the laser head housing and restricts pump light energy from escaping which can cause overheating of the laser head top, end plates, and shutter housings. Escaping pump lamp light can lead to laser rod end deterioration and severely reduced laser performance.

Always inspect the lamp flow tube during a lamp change, and replace it if the coated ends have deteriorated or there are any cracks or chips.

7.0 DEIONIZER PARTICLE WATER FILTERS:

The water purity of the closed cooling loop for the laser head must be maintained. Therefore, the system includes a particle filter and deionizer to remove contamination that would cause arc lamp current leakage and corrosion of the lamp reflector cavity. Every 6 months, the deionizer cartridge and particle filter should be replaced. Also, if the system is not used for a week, the pump should be allowed to run for half an hour to flush the reflector cavity and deionize the water.

8.0 ELECTRICAL/ELECTRONICS MAINTENANCE:

Typically, routine maintenance of the system's electronics is not required unless predicated by a system performance problem. It is therefore recommended that the customer contact U. S. Laser Corporation for technical assistance when a problem arises. Circuit schematics are provided for use by a qualified electronics technician.

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W A R N I N G ! !

ALL AREAS OF THE POWER SUPPLY CONSOLE CONTAIN HIGH VOLTAGES. SERVICE SHOULD ONLY BE PERFORMED VIA A QUALIFIED SERVICE TECHNICIAN. ALWAYS DISCONNECT THE MAIN POWER AND ALLOW 10 MINUTES FOR CAPACITORS TO FULLY DISCHARGE PRIOR TO OPENING POWER SUPPLY COVERS.

8.1 BOARD CLEANING:

Power supplies that are operated in excessively dusty areas may collect dirt on the Trigger and Current Regulator circuit boards. Because both these boards have high voltage areas, contamination can lead to voltage breakdown and power supply failure. For this reason, the boards should be inspected on a yearly basis for dirt accumulation.

If the dirt is not oily and dry, it may be carefully vacuumed off the boards. Be sure the circuit breaker is down in the off position and all capacitors have been discharged prior to performing any cleaning activity.

If the dirt is oily or otherwise adhered to the boards, the boards will have to be removed and cleaned with an environmentally safe flux remover.

To remove the Current Regulator Board, remove the two (2) top corner screws and extract the board from the connector. To remove the Trigger Board, remove four (4) centrally located screws which connect to the high voltage boost capacitors and extract the board from the connector.

After cleaning the boards, allow them to dry thoroughly and replace them. Be sure to replace the nylon spacer hardware on the Current Regulator board mounting screws. Be sure to replace and secure the four (4) capacitor connecting screws on the Trigger Board.

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9.0 PERIODIC MAINTENANCE SCHEDULE:

LASER PUMP LAMP	CHANGE AS REQUIRED, AVERAGE 200 HOURS
COOLING PARTICLE FILTER	CHANGE EVERY SIX (6) MONTHS
COOLING DEIONIZER FILTER	CHANGE EVERY SIX (6) MONTHS
COOLING RESERVOIR LEVEL	CHECK WEEKLY
COOLING WATER SUPPLY	CHECK MONTHLY & DRAIN
OPTICAL SURFACES	CHECK EVERY MONTH
REFER TO U. S. LASER OPTICS CLEANING MANUAL	CLEAN AS REQUIRED
OPTICAL ALIGNMENT	ALIGN AS REQUIRED

10.0 AIR PURIFICATION: (optional)

Systems equipped with air purification apparatus provide drying and filtering of shop air to be used for purging the laser rail plenum.

Periodically check the pressure regulator for indication of 15 p.s.i. maximum, adjust as required. Depending upon the quality of the air being delivered to the purification system, the filters may need to be changed frequently or occasionally.

Check the sight glass of each filter for contamination level. The particulate and liquid removal filters are self-draining. The vapor removal filter must be drained by opening the drain valve. Check the top red-green indicator on each filter. When no green is visible, the element must be replaced. Refer to Air

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Purification Filter drawing for replacement cartridge part numbers. For the vapor removal filter, replacement of the element is recommended at 400 hour intervals.