CO_2 LASER MACHINE MAINTENANCE MANUAL

Read and understand this manual before servicing machine.

Failure to follow instructions could result in death or serious injury.

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Safety/Policies

WARNING: The safety precautions below are mandatory guidelines that must be followed. LightObject will not be held responsible for damages or injuries resulting from improper use of the laser machine.

• **ALWAYS unplug the power cords before performing machine maintenance.**
• **ALWAYS** discharge the laser power supply before working around high voltage cables, power off the machine for at least one hour is a safe way to discharge it.
• **DO NOT** operate the laser machine until you have been properly trained.
• **DO NOT** make contact with any exposed wires on the machine while the laser is on.
• **NEVER** set anything in the path of the laser and/or on the worktable when not in use in case of misfiring.
• **NEVER** push or pull on the laser head housing or gantry while the laser is running.

Introduction

Proper maintenance can cut down components' replacement cost and maintain the quality of cutting/engraving. It is up to the machine owner's decision whether maintaining or replacing components is more cost effective.

In general, metal parts and electronics have longer service life than laser tube and plastic, but care should be taken for all components.

Some major goals of performing maintenance are:

Keep the working area safe, e.g. not causing fire or burning components.

Prolong the life of the laser tube, which could be the most expensive component of the machine.

Avoid unexpected downtime.

Mirrors & Lens

Dirty mirrors and lens can accumulate heat from the laser and be damaged. Keeping them clean is crucial to maintain high laser output power. However, excessive cleaning will scratch the mirrors and lens. It is better to have good ventilation to keep them dust free and reduce the frequency of cleaning.

These optical components are delicate, handle with care and wear gloves to avoid contamination of fingers' oil. Hold the optics by their edges. Use laboratory grade alcohol or acetone as cleaning agent. Do not reuse any lens tissue/cotton swab. Before putting back the mirrors and lens, clean the mounting components so dust will not fall onto mirrors and lens during installation.

Typical machine has three mirrors, one lens and one beam combiner(optional).

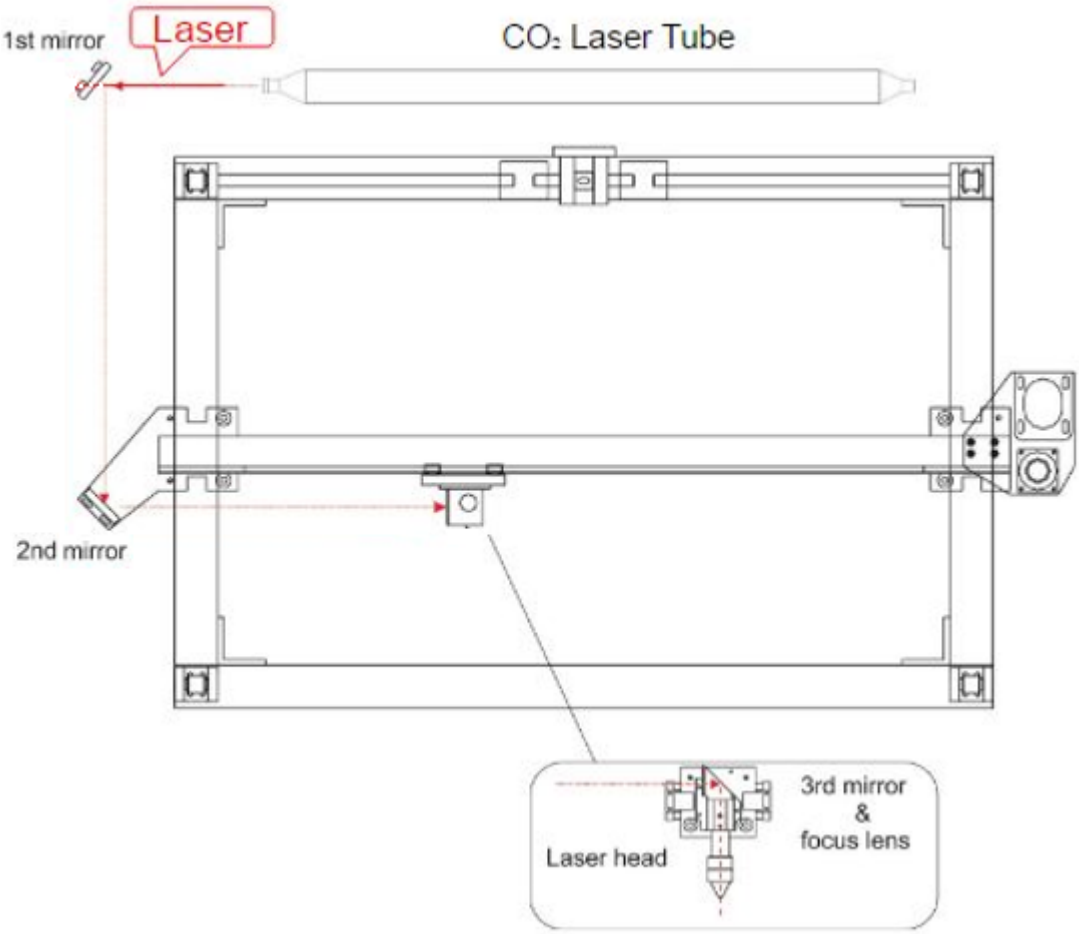

Fig. Location of mirrors.

It is easier to remove the mirrors from the mounts for cleaning. Different machines have different mirror mounts. Avoid touching the adjustment screws when removing/installing mirrors. For ring type mirror holder, use appropriate tool such as a round nose plier to grab the holes on the ring and turn counterclockwise. When installing, do not apply too much pressure on the mirror as it may damage the mirror.

Fig. Ring type mirror holder. Fig. Knob type mirror holder.

For hard coated optics, place a few drops of cleaning agent on them. Lay a lens tissue on the optics then gently drag it towards the edge of the optics. At the end of dragging, the dry part of the tissue can clean up the remaining solvent. For optics with soft coatings, do not apply force on the mirrors and lens. The above drop and drag method may scratch the coating. Use a rubber blower to gently blow away particles. Then use cleaning agent to dissolve the contaminant. Use a dry lens tissue held at the edge of the optics to suck the solvent.

If mirror cleaning has to be done without removing from the mount, use a cotton swab with cleaning agent to gently wipe the mirror from top to bottom. With the help of gravity, contaminant will be moved to the bottom of the mirror.

Fig. Nozzle assembly.

To remove the lens, first detach the air tube on the laser head. Loosen the thumbscrews to release the nozzle assembly. After removing the threaded retaining ring, use optic tissue to catch the lens. Remember the direction of the lens; convex side faces up. For ZnSe lens, a 10:1 water white vinegar solution can be used for cleaning human spittle. Turning air assist on during cutting/engraving can blow fume away from the lens.

Laser Tube

CO_2 laser tube's life can be greatly shortened if the working temperature is high, and will be damaged when the water inside freezes. To maintain a good cooling capability, keep the distilled water clean. Changing the water every two months can reduce the chance of mold infection. If the inner tube is coated by dirty material, flush it with a 20% HCl solution (**CAUTION**: HCl is corrosive to skin and metal, run it through the inner glass tube only). In the end, flush out the HCl with distilled water.

If space allowed, we do not recommend to remove the tube from the machine mounts as it could lose alignment when putting back. Before taking out the tube, using a marker to mark down where the tube and mount contact can help to minimize misalignment. If the machine has a spring strap, hold the screw when it comes out to prevent it from hitting the tube.

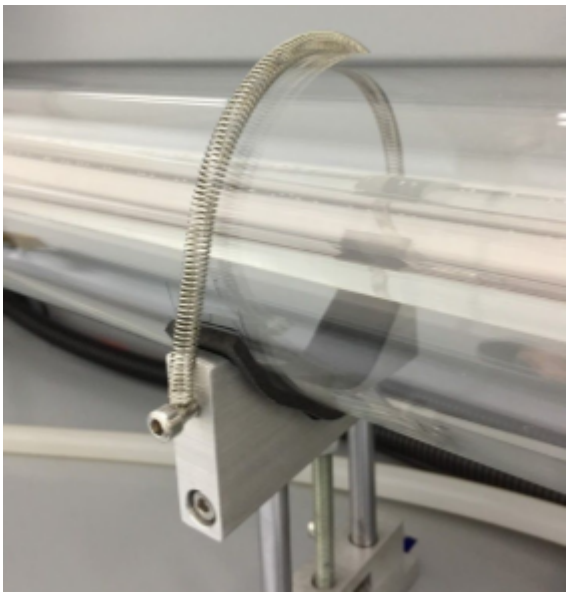

Fig. Spring strap tube mount.

Inside the laser tube, make sure there is no air bubble presents causing uneven temperature distribution. Drain the water then refill to remove air bubbles.

If the laser tube output mirror is dirty, heat could accumulate and damage the mirror. Use pure alcohol and degreased cotton swab to gently clean the mirror (refer to the Mirror maintenance guide). This mirror is not removable.

Gantry

Lubrication of linear rails and ball screws prolongs their life. The best type of lubricant depends on working temperature, humidity, travelling speed, and cost. A main source of rail wear comes from residue and debris. The frequency of linear rail maintenance depends a lot on the amount and size of dust created. In general, perform a maintenance every six months.

When the rails get dirty, use a clean rag to wipe away the contaminants, then apply lubricant. For rod and roller linear rail, apply general lithium grease on the entire metal rod. There are two rods for each axis. Avoid using graphite or molybdenum grease as it can make the balls within bearing to skid. Apply a thin layer of grease because too much grease can accumulate dust. Be aware that mixing different types of lubricant may change the lubrication property. For HIWIN linear rail, please refer to the manufacture's manual to determine the appropriate lubrication procedure for your specific model (https://www.hiwin.com/downloads.html#manuals).

Fig. Roller type bearing.

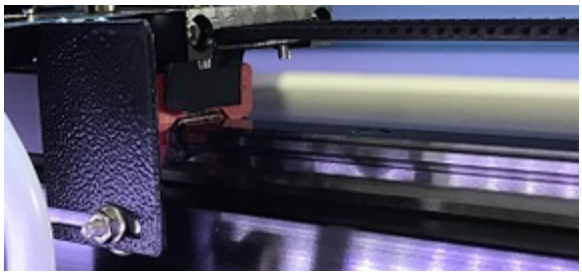

Fig. HIWIN type linear rail.

Keep the rubber timing belts dry and clean. Grease and oil can degrade the rubber belts. When replacing the timing belts, do not apply too much tension as it will apply too much stress on the bearings, affecting the stepper motors' performance. We suggest getting a feel of the tension when the machine is new.

For machine with z-table, inspect the ball screws every year. Usually, laser machine's z-table does not work under high speed and stress, not much maintenance is needed. Relubrication is needed after 700 hours of z-table movement, which could be the lifetime of the machine in many cases. If the ball screw gets stuck by debris/rust, disconnect the z-motor cable, and move the chain/belt by hand so that the debris is exposed. Clean out the debris with a clean rag, then reapply lithium grease.

Exhaust

A good exhaust system is the key to keep machine components clean. The environment around the laser machine should be kept clean so that the air going into the machine is clean. Clean out the machines' bottom tray to reduce the amount of dust when the exhaust is turned on. Improper exhaust can introduce dust into the power supply, causing arcing inside and damaging the power supply.

Fig. Dust tray.

If the machine is connected to an air filtration system, check the filters every month and replace when needed. The goal is to keep the air flow rate high so that dust and fume do not contaminate mirrors quickly.

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