SDZ CO_2 Laser Tube User Guide

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Introduction

Operating Principle of the SDZ Laser Tube

Application Fields: in the field of laser processing, laser tubes with various specifications can be used in the field of laser processing and hot treatment, for example, they can be applied to laser plotters, laser typewriters, laser cutters, laser drilling machine

Operating principle: concentrated carbon dioxide gas is excited through HV discharge to emit a laser beam at a wavelength of 10.6um.

Components: this product is made of three parts; they are hard glass unit, resonant cavity unit and electrode unit.

1. Hard glass unit, which is obtained from sintering a special material, consists of discharge tube, water cooling tube layer, gas tube layer and return-air tube, among which, the return-air tube is directly connected with the discharge tube and the gas tube layer. Its function is to excite the gas flow during the discharging process. Sealed-tube CO2 laser has a 3-layer sleeving structure with discharge tube as the center layer, water-circulating tube as the second layer, and gas tube as the outmost layer.
2. Resonant cavity unit is made up of total reflector and output reflector. The total reflector is generally made of optical crystal and coated with a gold film on its surface. Its reflection ratio at the wavelength of around 10.6 um reached up to 98%; while the output reflector is mainly made of infrared materials and coated with a dielectric film. It can allow a radiation at the wavelength of 10.6 um to be transmitted through (such as Ge, Si and Zn).
3. Electrode unit. Tube-shaped cold cathode is commonly used in CO2 lasers. Because the operational life of laser is dramatically affected by the material that is selected to make the cold cathode, those special materials with low reflection ration and low gas absorbing rate is required.

Installation and application

Firstly, make sure that the electrodes of the laser tube have been correctly connected.

Be sure that cooling water has been connected to the laser (appropriate professional water chiller must be applied when cooling the laser) in the way that water going in from the cathode and out from the anode without water leakage at the joints

Adjust the placement of the outlet pipes and ensure water-cooling tube can be 100% filled with cooling water. When the cooling water tube is 100% filled with cooling water, make sure that there are no bubbles inside or on the tube wall, and then you can switch on the power. The requirements for the cooling water are: particles larger than 50μm should be filtered form the distilled water or purified water. It is suggested that indoor temperature remain constant, which should be kept within 22℃ - 28℃. Avoid too high indoor temperature and too low water temperature, which would result in large temperature different and cause condensation on the surface of optical component inside the laser tube. Consequently, the machine would stop running. If the cooling water is too hot or freezing, it will cause damage to the tube.

Warning: it is worth notice that when using alternating current; please make sure the water tank is well connected to the ground.

When using the laser, in no conditions can gas cavity exist in the water-cooling tube, which may result in explosion or cracks on the laser tube.

The flow rate of the cooling water should be kept within 3L to 5L per minute; in the process of circulatory filling or water storing , low flow rate or bad flow will cause mode skip, laser beam would be scattered to form several dots and lead to a power decline; make sure the mouth of the water return pipe be kept in the middle of the cooling water tan. It should be avoided that the tube hasn’t be 100% filled up when turning on the laser. Turn off the laser when the cooling water flow rate is too low or the cooling water temperature is too high.

When the laser is working (including when debugging light path), avoid smoke sputtering. Any stains (such as dust or fingerprints) on the surface of the optical

lens of the laser outlet window will cause strong laser emission, which would burnout the surface or cause power dip. When performing laser spot test on organic glass, a distance of 300mm from the outlet glass should be kept.

Before fixing the laser tube, pleas adjusting the placement of the tube holder and so as to give full play to the equipment performance.

Caution: Avoid dust gathered around high voltage terminal and keep it clean and dry. Try to keep a distance from any kind of metal to avoid high voltage short circuit and discharge.

Given the narrowness of the cooling water tube, the cooling water flowing through it should not contain mineral substance, such as calcium carbonate. The maximum allowable hardness of the water is 15 °. After the cooling water tube is 100% filled with cooling water, cooling water would flow out without return pressure and fill up the tube constantly and circularly. Avoid the cooling water tube being blocked, which would cause poor cooling effect of the laser tube and a failure to 100% fill of the cooling water tube.

Water temperature fluctuation shall not exceed ±1 when the heat load varies from 10%-100%.

Testing current remains 29Ma; maximum allowable working current is 28mA; working current should be under 27mA if you intend to use the laser tube for a long time . By controlling current under 25mA, operating life can be ensured, while keeping the current at 16mA, optimal performance will be achieved. The above requirement s for the current should be based on the actual current shown on the ampere meter of the series-wound cathode ray cable.

Not operating according to the instructions or operating at excessive current level, operating life of the laser tube will be shortened greatly.

Screw fasteners on neither end of the SDZ G series laser tube should be loosened, or power dip would occur or even destroy the laser.

As the laser tube is glasswork, which is very fragile . No external force should be exerted on it during the installation and operation .

Safety Information

Please avoid harm or lost when operating the laser

Laser radiation:

Laser can produce a beam of highly-directed emitted light with single wavelength, which is totally different from light produced by ordinary light source. Energy produced by the laser beam radiate in form of heat. Laser processing (cutting, welding, heat treatment) can be seen as a process of controlled heating or burning. It is like flame machining but possess a better effect. The light energy of laser is in a thin beam of light which will remain the same even being radiated to a long distance. The light from ordinary light source is divergent and can lighten a large area when being radiated to a long distance. Due to the relatively small beam diameter produced by laser, laser is considered as an equipment that can produce high efficient and highly dense laser beams.

Laser wavelength is 10.6μm, far-infrared wavelengths in the light spectrum. Although it equals to heat energy, it cannot be seen by human eyes.

Any kind of strong light source or thermal source will potentially cause different degrees of damages on human eyes, for example, direct exposure of skin under laser beams will cause severe burn wound. In addition, as laser beams are easy to reflect on the bare mental surface, the secondary reflection or scattered light would cause safety threat.

Ways to avoid laser emission:

(1) Do not gaze toward laser beams

(2) Avoid any unnecessary direct or indirect emission (reflection)

(3) Keep wearing professional safety goggles when coming near the laser beams

Laser processing

Flammable subjects, gas or steam are easily inflamed under laser light, the inflamed smoke and gas will emit poisonous gas. When heated or inflamed, some materials would perform chemical decomposition forming gas or particle steam, which poses potential dangers. Such materials are PVC and some kinds of synthetic fiber glass and etc. Please contact the materials manufacturers for materials' features before processing.

The nature of materials that accept laser light

Three different situations will occur when a beam of laser light radiates on a subject

1) Transmitting diffuser---materials that can constantly transmit laser energy without changing its nature. For example, air and some selected special crystals (such as the material made for laser output window) are such materials.

2) Materials that can reflect almost all the laser energy radiated on the materials. After polished, such materials with delicate surface can be used as optical lens to turn or change the course of beam path.

3) Absorbers---materials that cannot transmit or reflect laser energy. For CO2 laser energy, most of the materials are good absorbers.
In view of safety, some absorbers can be made into beams receiver, for they can avoid dangers by absorbing the energy radiated on them. But some receivers, such as flammable solvent, flammable materials, are easily inflamed under laser, paper, and oil cloth easy to produce fire. Measures can be taken to avoid fire in laser processing:

1) Make sure fire extinguishers is readily accessible.
2) Turn off laser or optical shutter when not processing
3) Clearly divide the units. Pay special attention to preventing slag from spilling out of the bottom or the fringe of the equipment
4) Do not place paper, cloth or any other flammable subjects near the laser light path without any protection
5) No machines used in thunderstorm season. Pull out of power lines and data lines lest be stroke by lightning.

High voltage:
The laser carries 30KV high voltage and its anode carries high voltage. Please notice its security identifier (SID). For safety, please measure the voltage on the component by high voltage meter to see if it has discharged.

Any operation on the laser equipment should meet the safety requirements! Especially remind for personnel involving installing, operating, or maintaining laser equipment, if there is any problem or question on safety protection, please promptly contact the laser equipment manufacturers without hesitation. The instruction is aimed at preventing any kind of potential dangers from happening. Please refer to relevant books and technical information for other safety protection measures that are not mentioned in this instruction.

Maintenance and Care

Before starting the laser, be sure that the water circulation system is in normal condition and there are no gas bubbles in the tube; check every link, component and equipment related to the water circulation system. Examine now and then whether the output reflector connected with the cathode is covered with dust or oil, which would affect the power and the laser beam of the output reflector and directly shorten the life of operation of the laser.

Cotton balls should not be used to clean the surface of the laser output window, or its power will be affected.

Measures to remove stains on the output window glass:

1). Don’t’ start the laser as the reflectors are contaminated;

2) Angle air-blowing the lens surface

3) Compress absolute alcohol with work drum and spray it on the lens surface. Turn on laser after the alcohol completely volatiles.

4) Please consult professionals for cleaning the glass if above mentioned measures doesn't work

5) Avoid using acetone for cleaning

Cautions and Troubleshooting

Since the gas tube within the laser is filled with inactive mixed gas, the tube itself is uninflammable and, but the following reasons are likely to result in an explosion or cracking.

- Exposure to those flammable and explosive materials(solid, gas or liquid);
- External force exerted on laser tube
- Cooling water temperature is too high;
- The cooling water tube is not 100% filled with water;
- The laser tube or the cooling water tube is frozen because of the cold weather, which will lead to a frost cracking;
- Gas bubbles are found in the cooling water tube;
- The inlet and outlet pipes are broken or blocked or there are some water left in the laser.
- The pressure and flow of the cooling water is inadequate;
- Electrode heating, cracking of glass that connects electrode or tube wall breakdown caused by short circuit;
- When connecting the anode and the cathode, wrongly or excessively force it, welding by electric iron, or heating of electric needles will cause the electrode and glass cracking or breakdown, which will lead to laser tube leaking;
- Discontinuous shutdown occur when water pump is in operation

- Most of the explosions and cracks are directly related to the water. Please carefully check cooling water and every component related to the water before use laser.

Problems: carving depth becomes shallower

Solutions:

- In the spot-light mode, check the control panel to see if current is normal
- Check if supporting point of laser tube is appropriate
- Check if light intensity is too small or light path is diverted
- Check if the focal length is correct;
- Check if the reflector surface is free from scratch and dust;
- Check if the flow rate and current pressure of cooling water is in normal condition;
- Check if lens inside the laser tube output window is scrapped or stained;
- Check if the power supply is normal;

If problem still exists with all above-mentioned results being normal, please contact your SDZ exclusive service provider.

Problem: high voltage fire fighting and discharging

Solutions:

- Check if high pressure head is surrounded by accumulation of subjects or dust content;
- Check if high pressure head is in moist environment or close to walls;
- Check if high pressure head is close to metal part of the equipment;
- Check if high voltage connecting device of the power supply is off the holder;
- Check if high voltage connecting device is disconnected or destructed;
- If all above-mentioned results are normal, please dispart and remount the laser tube;

If problem still exists when all above-mentioned results are normal, please contact your SDZ exclusive service provider.