Operating Instructions for Laser Cutting Machine

Declaration

The company shall not be liable for any direct indirect,incidental or consequential damages or liabilities arising from improper use of this manual or this product.

The information in this manual is for reference only. Due to reasons such as improved design and functions, the company reserves the final right of interpretation of this manual. In case of any content changes, no separate notice will be given.

Notice: Operating machinery is dangerous! Failure to handle it promptly may cause fire, and personnel must not leave the site during the cutting process.

This type of laser cutting machine is a Class 4 laser product as defined in GB (Guobiao, Chinese National Standard). Please be aware of laser radiation when it is operating.Avoid direct or scattered radiation exposure to the eyes or skin.

Overview:

This instruction applies to all beam-type cutting machine models manufactured by Yuxuan Laser.

Working environment

Good ventilation, clean environment, and low dust; Storage space temperature: 0-50°C; Working space temperature: 5-40°C;

Relative humidity of the working space: 30%-85% (no condensation).

Requirements for the power supply

The laser cutting machine uses alternating current of AC 220V/50Hz . If the local voltage is unstable, please install a voltage stabilizer by yourself to ensure the normal operation of the laser cutting machine. Before plugging in or unplugging the power cord, please turn off the power switch of the laser cutter first.

Precautions

No-working hour precautions

Please don’ t allow non-professionals to repair or debug the electrical systems.It will reduce the safety performance of the equipment,expand the fault,and even cause personal injury and property damage.

Please do not pile up debris around the chiller.During operation,regularly remove dust from the surface of the chiller and its filter screen on maintain good ventilation of the system and facilitate heat dissipation.

Do not modify the product without authorization;the company shall bear no responsibility for any consequences arising therefrom!

Warning

When it is really necessary to open the chassis cover,you are only allowed to touch the components inside the electric control box 5 minutes after the power is cut off and under the guidance of professional personnel,as there is a 10000-volt high-voltage pack inside the machine!

Prohibition

When the machine is in operation,do not touch any moving parts or open the control equipment;otherwise,it may cause personal injury or result in the machine malfunctioning!

Electrical equipment is prohibited from operating in damp,dusty,corrosive gas,or flammable and explosive gas environments;otherwise,it may cause electric shock or fire!

Laser Cutting User Manual

1 objective

This regulation is used to guide operators to correctly operate and use the equipment.

2 Scope of Application

This procedure is applicable to guiding the daily operation and safe use of the laser cutting machines in this unit.

3 Operating Procedures

3.1 Laser

3.1.1 Ensure the laser is powered by the "regulated" output of a stabilized voltage power supply.

3.1.2 Ensure that the air compressor is clean and the air pressure meets the laser' s requirements.

3.1.3 Ensure the cooling system operates reliably and stably,with its temperature,pressure,and flow rate meeting the laser' s requirements to guarantee the laser' s reliable and stable operation.

3.1.4 Do not operate the laser with its cover open to ensure safety.

3.1.5 When opening the door to maintain the laser,ensure that the high-voltage power supply is disconnected and locked.Before touching live components,ensure that the high-voltage electricity has been completely discharged to the ground.

3.1.6 Regularly monitor the flow rate,pressure,and temperature of the cooling water,the discharge current of the laser,as well as the temperature and sound of the turbine.

3.1.7 Conduct regular maintenance and inspection on the laser.

3.2 Water chiller.

3.2.1Ensure the water chiller has a stable power supply and correct phase sequence; ensure the top exhaust fan maintains unobstructed heat dissipation.

3.2.2 Ensure the cooling water composition meets the requirements;note that the water temperature setting corresponds to that of the laser;check the water level,water quality,and pipelines weekly.

3.2.3 Replace the cooling water every 3-6 months based on changes in water quality and pH value.

3.3 Main unit

3.3.1 Start up and shut down strictly in accordance with operating sequence.

3.3.2 During the operation of the machine tool,it is strictly prohibited for personnel and objects to enter the workbench to ensure the safty of both humans and the machine.Operators must stay focused and press the "Emergency Stop" button as soon as possible in case of dangerous situations.

3.3.3 When adjusting the machine tool' s optical path and the cutting head in follow-up mode,the correct operating sequence must be followed to ensure the safety of both humans and the machine.

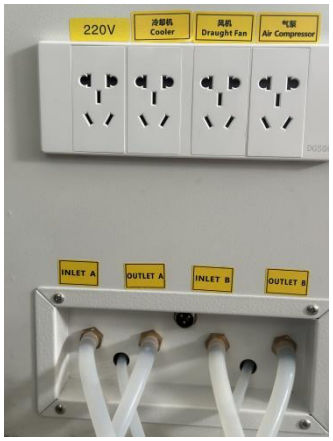
3.3.4 Every time the machine is started,return to the reference point,inspect and clean the focusing lens,calibrate the coaxiality of the beam and nozzle,turn on the cutting auxiliary gas,and ensure the pressure inside the cylinder is not less than 1 MPa.

3.3.5 Check the external optical path protective gas,cold circuit cabinet,cooling water circuit,air compressor,and refrigerated air dryer once a week,and drain the accumulated water in the filter.

4.Operating steps

4.1 Connect the 220V power cable at the right rear of the machine and ensure proper grounding.

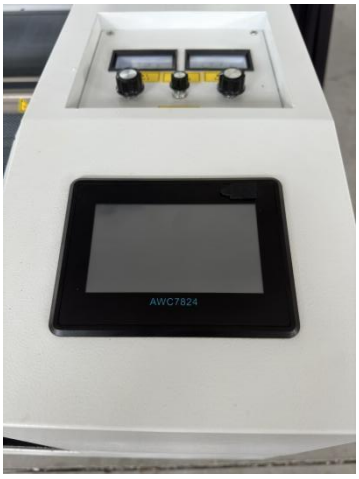
4.2Connect the chiller signal wire, chiller water inlet and outlet pipes, and air pump blowpipe at the left rear of the machine.



4.3 Connect the fan duct at the rear of the machine.

4.4 Turn on the power switch on the right side of the machine, and then turn on the lighting, the fan, the air pump, and the laser switch in sequence.

4.5 The laser operation is controlled by the control panel on the right side, and the potentiometer can adjust the laser power in real time.



Precautions for Using a Laser Cutting Machine

1. Before using the laser cutting machine, first turn on the chiller to fill the laser tube with water. During the machine's operation, frequently check the water flow to ensure the water circulation in the laser tube is normal and unobstructed. Never bend or block the cooling water pipes! The water in the water tank must be kept clean, and the water temperature shall not exceed 35°C during operation.

2. This laser product is a flat-panel cutting model. Cutting special materials poses the risk of hitting the laser head. Remember to lay the material flat before cutting; otherwise, the manufacturer will not provide warranty services for a damaged laser head.

3. The laser generated in the laser tube is highly hot. During operation, pay attention to the laser's optical path (especially when adjusting the light) to avoid laser burns. Never place your skin under the laser head while the machine is working.

4. When the laser cutting machine is in operation, especially during cutting, be aware of interference with surrounding electronic devices. Do not place mobile phones or other communication devices near the machine.

5. Never run the laser cutting machine at full power for a long time; it is recommended to set the maximum cutting power to 90% - 95%.

6. Never place flammable or explosive items near the laser cutting machine to prevent fires caused by laser deviation.

7. Never place any irrelevant specularly reflective or diffusely reflective objects in the equipment to avoid laser reflecting directly onto the human body or flammable items.

8. Since the machine contains laser and high-voltage components, unauthorized disassembly by non-professionals is strictly prohibited.

9. If the machine malfunctions or a fire occurs, cut off the power supply immediately.

10. During the machine's operation, the operator must observe the machine's working condition at all times (e.g., whether the paper laid for edge tracing is blown up by the air pump to block the laser, whether the machine makes abnormal noises, the water temperature of the circulating water, etc.). The operator is strictly prohibited from leaving the post.

11. Follow the machine's startup and shutdown sequence: For startup, first turn on the chiller, then the main power supply of the machine, followed by the air pump and fan switches, and finally the laser switch. For shutdown, first turn off the laser switch, then the air pump and fan switches, followed by the power switch, and finally the chiller.

12. When processing workpieces, the smoke exhaust and air-blowing equipment (air compressor) must be turned on to prevent smoke and dust from contaminating the focusing lens and reflective lens. Otherwise, the focusing and reflection performance of the lenses will be affected, which in turn affects the processing intensity and precision.

13. Cleaning of reflective lenses and focusing lenses: Pinch the reflective lens with two fingers, and use the other hand to dip a camera lens cleaning paper into the cleaning solution to gently wipe across the lens surface. Never press the lens surface with your fingers to avoid

scratches; alternatively, dip a cotton swab into the camera lens cleaning solution to gently wipe the focusing lens until it is clean and bright.

14. Conduct formal processing. For materials that have not been processed before, follow the principle of increasing the power from low to high.

15. When changing the water, use a clean water pipe or basin. Never use an oily basin to prevent oil stains from sticking to the inner wall of the laser tube, which will seriously affect the service life of the laser tube.

Equipment Daily Maintenance

Water Replacement and Water Tank Cleaning

It is recommended to use pure water, and the circulating water of the water chiller must be replaced at least once every 90 days.

Note

Ensure the laser tube is fully filled with circulating water before the machine starts working.

The water quality and temperature of the circulating water directly affect the service life of the laser tube. It is recommended to use pure water and keep the water temperature below 35°C. If the temperature exceeds 35°C, replace the circulating water immediately. When replacing the circulating water, wait for the laser tube to cool down first. Never replace water or add water to the tank while the machine is in operation.

Water Tank Cleaning (Circulating Water Replacement)

1. First, turn off the laser power supply.

2. Add new water and run the chiller for 2-3 minutes (to fill the laser tube with circulating water), then drain the water.

3. Repeat the above step (adding new water, running, and draining) 2-3 times.

Lens Cleaning

There are 3 reflective mirrors and 1 focusing lens on the laser cutting machine:

- The 1st reflective mirror is located at the emission outlet of the laser tube (i.e., the upper left corner of the machine).

- The 2nd reflective mirror is located at the left end of the crossbeam.

- The 3rd reflective mirror is located on the top of the fixed part of the laser head.

- The focusing lens is located in the adjustable lens barrel at the lower part of the laser head.

Laser is reflected and focused by these lenses before being emitted from the laser head. The lenses are prone to dust or other contaminants, which may cause laser loss or lens damage.

Cleaning Steps

1. For the 1st and 2nd reflective mirrors: There is no need to remove them. Simply take a cotton swab dipped in cleaning solution and gently wipe the lens in a rotating motion from the center to the edge.

2. For the 3rd reflective mirror and focusing lens: First, remove them from their holders. Wipe them in the same rotating motion (center to edge) with a cleaning solution-dipped cotton swab, then reinstall them in their original positions after cleaning.

Notes

- ① Wipe the lenses gently to avoid damaging the surface coating.

- ② Handle the lenses with care during the cleaning process (take and place them lightly).

- ③ When reinstalling the focusing lens, ensure the convex side faces upward.

Guide Rail Cleaning

(It is recommended to clean once every half a month, and the operation must be done with the machine turned off.)

As one of the core components of the equipment, the guide rails and linear shafts function as guidance and support. To ensure high processing precision of the machine, the guide rails and linear shafts are required to have high guiding accuracy and good motion stability. During the operation of the equipment, the processed workpieces will generate a large amount of corrosive dust and smoke. Long-term and massive deposition of such smoke and dust on the surfaces of guide rails and linear shafts will greatly affect the processing precision of the equipment, and may form corrosion spots on the surfaces of guide rails and linear shafts, shortening the service life of the equipment. To ensure the machine works normally and stably and guarantee the processing quality of products, it is necessary to carefully perform daily maintenance on the guide rails and linear shafts.

Note

Prepare a dry cotton cloth and lubricating oil when cleaning the guide rails.

The guide rails of the cutting machine are divided into linear guide rails (rails and sliders) and roller guide rails (synchronous wheels, bearings, eccentric shafts).

Linear Guide Rail Cleaning

1. First, move the laser head to the far right (or far left).

2. Wipe the guide rail surface with a dry cotton cloth until it is bright and free of dust.

3. Add a small amount of lubricating oil to the guide rail.

4. Slowly move the laser head left and right several times to ensure the lubricating oil is evenly distributed.

Roller Guide Rail Cleaning

1. Move the crossbeam to the inner side.

2. Open the end covers on both sides of the machine.

3. Wipe the contact areas between the guide rails and rollers on both sides with a dry cotton cloth until clean.

4. Move the crossbeam to clean the remaining areas. No oiling is required for roller guide rails.

Screw and Coupling Shaft Tightening

After the motion system has been in operation for a period of time, the screws and couplings at the motion joints may loosen, which will affect the smoothness of mechanical movement. Therefore, during the machine's operation, it is necessary to observe whether the transmission components produce abnormal noise or phenomena. If any problem is found, tighten and maintain them in a timely manner. At the same time, the machine's screws should be tightened one by one

with tools at regular intervals. The first tightening should be carried out approximately one month after the equipment is put into use.

Optical Path Inspection

The optical path system of a laser cutting machine is jointly composed of reflectors and a focusing lens. Generally, there is no deviation issue in the optical path initially. However, as the machine is used over time, factors such as machine vibration and aging may cause the optical path to deviate. It is recommended that users check whether the optical path is normal before starting work.

(In particular, if problems such as weakened laser during cutting or poor cutting results occur, please first check the optical path. For adjustment methods, refer to the Optical Path Adjustment Instructions.)

Common Problems and Solutions for Laser Cutting Machines

No Laser Emission from the Laser Head

1. Press the test button on the operation panel and observe the ammeter status:

2. - ① No current: Check if the laser power supply is connected, if the high-voltage wire is loose or disconnected, and if the signal wire is loose.

- ② With current: Check if the lens is broken and if the optical path is severely deviated.

2. Check if the water circulation system is normal:

- ① No water flow: Check if the water pump is damaged or not powered on.

- ② With water flow: Check if the water inlet and outlet are reversed or if the water pipe is broken.

3. Laser emits in test fire and self-inspection, but not when sending data: Check if the computer settings are correct.

Instructions for Adjusting the Optical Path of Laser Cutting Machine

I. Adjustment of Parallel Optical Path

1. First, ensure the laser beam emitted from the laser tube hits the center of the 1st reflective mirror. If there is an error, adjust the laser tube left/right or up/down, but the laser tube must remain horizontal.

2. Attach double-sided tape in front of the 2nd reflective mirror. Move the X-axis to the position closest to the laser tube, press the test fire button (set the light intensity within 30%), and mark the spot. This mark should be at the center of the 2nd reflective mirror.

Important Reminder: To prevent laser radiation injury, first use a large cardboard to test the approximate position of the laser spot and confirm the laser can hit the effective area of the 2nd reflective mirror before adjustment.

3. Gradually move the crossbeam to a position slightly farther from the laser tube, press the test fire button, and mark the spot.

- If the two spots are severely deviated, adjust the three adjustment screws behind the 1st reflective mirror until the two spots coincide.

- If the deviation is small, do not adjust the screws of the 1st reflective mirror.

Then move the X-axis to the farthest position from the laser tube and test again.

4. If the two marks do not coincide, adjust the 1st reflective mirror (by turning the screws behind the mirror holder) to align their centers.

5. Repeat Steps 2 to 4 until the centers of the two marks are completely coincident.

6. Attach double-sided tape in front of the 3rd reflective mirror. Move the laser head to the position closest to the 2nd reflective mirror, press the test fire button, and mark the spot.

7. Gradually move the laser head to the farthest position from the 2nd reflective mirror, press the test fire button, and mark the spot.

(At this time, move the laser head away from the 2nd reflective mirror in multiple segments to avoid the laser deviating seriously from the effective area of the laser head’ s reflective mirror in one move.)

8. If the two marks do not coincide, adjust the three adjustment screws behind the 2nd reflective mirror to align their centers.

9. Repeat Steps 6 to 8 until the centers of the two marks are completely coincident.

10. Attach double-sided tape to the light inlet hole in front of the 3rd reflective mirror, press the test fire button, and mark the spot. The adjustment is qualified if the spot is at the center.

11. If the laser does not hit the center of the light inlet hole but the spot is still coincident (deviated outward and upward):

- (1) Solution for upward deviation: Lower the entire laser tube by 2-3mm, then re-adjust according to Steps 1 to 10.

- (2) Solution for outward deviation: Move the entire 2nd reflective mirror holder 2-3mm toward the laser tube (do not touch the adjustment screws of the reflective mirror; only move the fixed

screws of the 2nd mirror holder). This step can be done simultaneously with Step (1) before re-adjustment.

12. Adjustment of the focusing lens:

- First, turn the three adjustment screws on the laser head (above the 3rd reflective mirror) clockwise to tighten, then turn them counterclockwise by half a circle at the same time (to leave a gap for easy adjustment).

- Stick double-sided tape to the light outlet under the laser head, press the test fire button for 0.1 seconds, then remove the tape. Check if the laser hits the center of the light outlet—if yes, the optical adjustment is completed.

- If the laser deviates to one side of the light outlet, turn the adjustment screw in the same direction on the laser head clockwise. (Due to direction issues, you may need to adjust two corresponding screws sometimes. Adjust by no more than 1/10 of a circle each time; do not rush for quick results.)

II. Adjustment of Vertical Optical Path

1. Place a 10mm acrylic sheet on the machine workbench, cut a 20x15mm rectangle, and check the verticality of the cut edge. Alternatively, directly press the test fire button to drill a hole and observe its verticality.

- 2. If the laser beam deviates left/right, adjust the height of the laser tube.

- If the laser beam deviates forward/backward, adjust the front/back position of the laser tube base.

- If the deviation is slight, only make minor adjustments until the laser beam is vertical in all directions (front, back, left, right).