

SENFENG

Laser Cutting Machine

User Manual

Product model:SF3015H

Identification of product :

JINAN SENFENG LASER TECHNOLOGY CO.,LTD

www.senfenglaser.com

Preface

Thank you for purchasing our product. We are committed to providing you with comprehensive services.

The following guidelines and harmonized standards were observed during the development and production of the laser system:

- EC Machinery Directive 2006/42/EC
- EMC Directive 2014/30/EU
- DIN EN ISO 11553-1:2021 Safety of machinery – Laser processing machines
- DIN EN ISO 12100: Safety of machinery – General principles for design – Risk assessment and risk reduction
- DIN EN 60204-1 VDE 0113-1:2007-06

Safety of machinery - Electrical equipment of machines

- DIN EN IEC 6100-6-2: Electromagnetic compatibility (EMC)
- DIN EN IEC 6100-6-4: Electromagnetic compatibility (EMC)

This product is a high-tech integration of optics, mechanics, and electronics, independently developed and manufactured by our company. It features a compact structure, high precision, long service life, elegant appearance, and cost-effectiveness. To ensure proper operation and maintenance of the equipment, please read this manual carefully before putting the equipment into official use.

This manual contains a large number of practical illustrations, aiming to present information in a clear, illustrated and easy-to-understand manner. It is essential to gain a thorough understanding of the machine's principles, structure, performance, daily maintenance, safety precautions, and other basic knowledge. Mastering correct operating procedures and improving the ability to handle faults in emergency situations are crucial for ensuring the safety of personnel and the machine, as well as preventing accidents caused by improper operation and incorrect fault handling.

If you have any questions or doubts, please contact our after-sales service department promptly. Do not operate the machine until the problem is resolved.

Complimentary Documentation

Complementary documentation in digital versions can be found on the computer hard drive D from the machine.

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1. Company Profile

Jinan Senfeng Laser Technology Co., Ltd. is one of the largest laser equipment manufacturers in China. The company focuses on the R&D, manufacturing, and sales of high-power laser processing complete sets of equipment, including high-power laser cutting machines, laser welding machines, and multi-functional laser processing equipment. It provides customers with personalized and professional laser processing system solutions. Senfeng Laser's leading products cover the full power range of fiber laser cutting series, laser marking series, laser processing special equipment, and cutting complete sets of equipment. These products are widely used in industries such as iron and steel metallurgy, non-ferrous metals, automobiles and auto parts, aerospace, military electronics, precision instruments, machinery manufacturing, hardware tools, integrated circuits, and solar energy.

The company advocates the concept of "taking customers' interests and needs as the foundation" and is committed to "creating value for customers and benefits for society". The advanced nature of technology is the guarantee of product quality. The company has independent intellectual property rights and has established a sound and effective quality management system and internal control system. The company's product service is based on prevention, and it has implemented a service mechanism featuring customer return visits, continuous improvement, rapid response, and high efficiency and accuracy to ensure the stable and efficient operation of products and help customers maximize economic benefits. The sales network covers the whole country and expands to overseas markets, and the products have won high recognition from customers. The company is willing to make progress and develop together with all partners to build the largest domestic manufacturing and R&D base for high-power laser processing complete sets of equipment.

•Products

Senfeng Laser provides customers at home and abroad with a complete set of laser processing solutions and related supporting facilities. Its main products include

multiple series of industrial laser equipment and their supporting products, such as fiber laser marking machines, laser welding machines, and fiber laser cutting machines. These products are widely used in industries such as the advertising industry, sheet metal industry, instruments and meters, printed circuits, computer manufacturing, mobile communications, auto parts, precision machinery, building materials, clothing and apparel, urban lighting, gold and silver jewelry, craft gifts, and printing and plate making.

•Quality

In accordance with the ISO9001 quality control system, Senfeng Laser strictly controls the incoming materials, processing process, complete machine, and delivery of finalized products to ensure the performance and quality of delivered products.

•Service

Senfeng Laser has specially established a Marketing Management Center, with multiple branches and more than 100 offices across the country. At the same time, it has set up more than a dozen branches overseas, with resident technical service personnel to provide customers with comprehensive pre-sales, in-sales, and after-sales support and services. Where there are Senfeng Laser products, there are high-quality services provided by Senfeng people!

2. Safety Specifications

2.1 Safety Standards

Before operating the machine tool and conducting daily maintenance, operators must carefully read this chapter to understand the safety measures and requirements of the machine tool and comply with the relevant safety precautions.

The laser processing equipment and its operation shall comply with the two national standards: GB7247-2012 "Safety of Laser Products - Classification, Requirements and User's Guide" and GB10320-2011 "Electrical Safety of Laser Equipment and Installations".

According to Clause 9 of the European Standard EN 60825-1, the laser of this equipment is a Class 4 laser device.

2.2 Definition of Safety Terms

This chapter elaborates on safety concepts and explains how to avoid potential hazards. The overview of residual risks lists the measures that operators should take to reduce residual risks.

Operators must comply with valid safety and accident prevention regulations of their respective countries, as well as state and regional safety laws!

Certain operations may pose hazards during operation. Warning prompts are attached before the relevant operation instructions, and warning signs are also installed on the equipment.

Warnings include signal words as explained in the following table:

Signal Word	Description
Danger	Indicates an immediate and serious hazard. Failure to take precautions may result in death or serious injury.

Signal Word	Description
Warning	Indicates a potentially hazardous situation. Failure to avoid it may result in serious injury.
Caution	Indicates a possible hazard. Failure to avoid it may result in injury.
Notice	Indicates a situation that, if not addressed, may result in property damage.



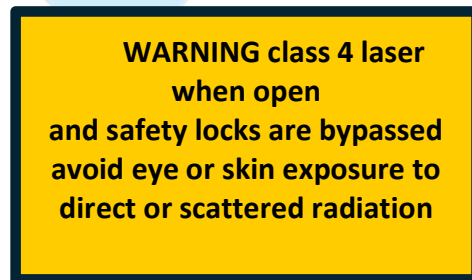
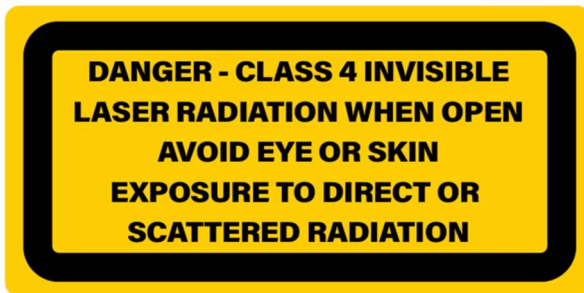
- Load Hover!
- Falling goods may cause serious bodily injury or even death.
- Comply with safety regulations for heavy cargo handling.
- Never walk under a suspended heavy load.
- Use slings that have been tested and suitable for the weight.
- Assign qualified technicians to be responsible for equipment transportation.
- Transportation shall comply with transportation regulations.

2.3 Safety Labels





Exit Laser Beam



2.4 Hazard Identification and Prevention

2.4.1 Laser Radiation Hazard

Laser Classification: According to Clause 9 of the European Standard EN 60825-1, the lasers of this series are Class 4 laser devices. This product emits laser radiation with a wavelength of 1080nm or around 1080nm.

Hazard Consequences: Direct or indirect exposure to such light intensity can cause damage to the eyes or skin. Although the radiation is invisible, the laser beam can cause irreversible damage to the retina or cornea.

Preventive Measures: Wear goggles matching the laser wavelength (complying with IEC/EN 60825-1, EN 207, or the US ANSI Z87.1 standard). Do not confuse goggles of different wavelengths. Do not look directly at the laser beam or its reflected light, and avoid staying in the laser radiation area.

2.4.2 Intense Light Hazard

Hazard Source: During laser processing, secondary radiation is generated, including ultraviolet rays (<400nm), intense visible light, and infrared rays (>780nm). The intense light hazard is more significant when processing galvanized steel sheets.

Preventive Measures: Do not look directly at the intense light at the processing point without eye protection. Wear dark goggles.

2.4.3 Electrical Hazard

High Voltage and Electric Shock: There are high-voltage components inside the electrical cabinet and laser equipment. The power supply of the fire-extinguishing system is not controlled by the main switch of the machine, posing a risk of electric shock.

High-Temperature Components: Components inside the electrical cabinet may become hot during operation, posing a risk of burns.

Preventive Measures:

Only certified electricians are allowed to open the electrical cabinet. Before opening, turn off the main switch, lock it, and wait for discharge (for at least 5 minutes) or cooling (for at least 5 minutes).

Before touching electrical components, confirm that there is no live voltage. During maintenance, cut off the power supply of the laser equipment and prevent accidental startup.

2.4.4 Workpiece Handling Hazard

Sharp Workpieces: The edges of workpieces after laser cutting are sharp and may scratch the skin.

When handling workpieces, must wear protective gloves and safety shoes, and use auxiliary tools (such as tweezers, suction cups) to pick up and place workpieces.

Hot Workpieces: Workpieces after processing have a high temperature (may exceed 100°C), which may cause burns.

Wait for the workpieces to cool down before handling, or use high-temperature-resistant auxiliary tools to pick up and place them. Do not touch the high-temperature surface directly with hands.

2.4.5 Dust, Particle, waste gas Hazard

Dust, Waste Particle and Waste Gas: Laser cutting of metals (such as stainless steel) generates dust, waste particle. Cutting of materials such as cutting oil and polyethylene film generates harmful gases (such as alkanes), which are harmful to health if inhaled. Check with the supplier/material manufacturer for information on toxic effects.

Preventive Measures: Ensure the dust removal fan operates normally, and the exhaust pipeline meets the installation requirements (e.g., maximum length of 10 meters, maximum of 1 90 elbow). The waste gas generated during stainless steel processing must be discharged outdoors.

Wear a dust mask during maintenance of the extraction system, ensure good

ventilation of the work area and clean the filter element of the dust collector regularly. The machine may only be used with a properly installed and operational extraction system. Please also read the operating instructions for the dust collector.

2.4.6 Fire Hazard

Fire-Causing Factors: During laser cutting, oxygen is often used. Combined with the splashing sparks during cutting, oxygen may easily cause a fire hazard.

Preventive Measures: Prohibit the placement of flammable and explosive materials in the work area, and prepare fire-fighting equipment. Conduct regular fire-fighting knowledge training for operators.

2.5 Safety Devices and Their Use

2.5.1 Core Safety Devices

Device Name	Function Description	Usage Requirements
Main Switch (8)	Controls the power-on/power-off of the machine. A lock can be added to prevent accidental startup.	Cut off the power when turned off; the equipment is powered on when turned on. The main switch must be locked during maintenance.
Emergency Stop Button (5)	When triggered, it cuts off the control power of the machine, turns off the laser beam, and stops the axis movement.	Press it immediately when a hazard is detected. The equipment can only be restarted after the fault is eliminated.
Light Curtain (1)	Used for the protection of the external hazardous area of the pallet changer. When the light curtain is interrupted, an alarm/warning is triggered.	Check the effectiveness of the light curtain regularly and avoid blocking by foreign objects.
Equipment Operation Indicator Light (4)	Displays the operation status of the equipment.	When the equipment is in normal use, it displays the equipment status. When the indicator light is red, the equipment will alarm and stop

Device Name	Function Description	Usage Requirements
		working.
Observation Window (2)	Allows observation of the interior of the equipment during operation	Can be used when the safety door is functioning.
Safety Door (10)	It is a fully enclosed safety cabin. The safety door is locked, and the laser beam is only activated when the safety door is closed	An alarm will be triggered when the safety door is opened. It is prohibited to dismantle or disable the safety door.

As shown in the figure below:



2.5.2 Personnel Qualifications and Training

Requirements for Authorized Personnel: Only personnel who have received training and obtained authorization can operate, set up, and maintain the equipment. Authorized personnel must master:

Hazard identification and prevention measures of the equipment, as well as the hazards of laser radiation to the human body and protection methods.

Inspection and use of safety devices, and the operation procedure of the emergency stop button.

Reading and understanding of technical documents (such as this manual, software operation instructions).

Training Requirements:

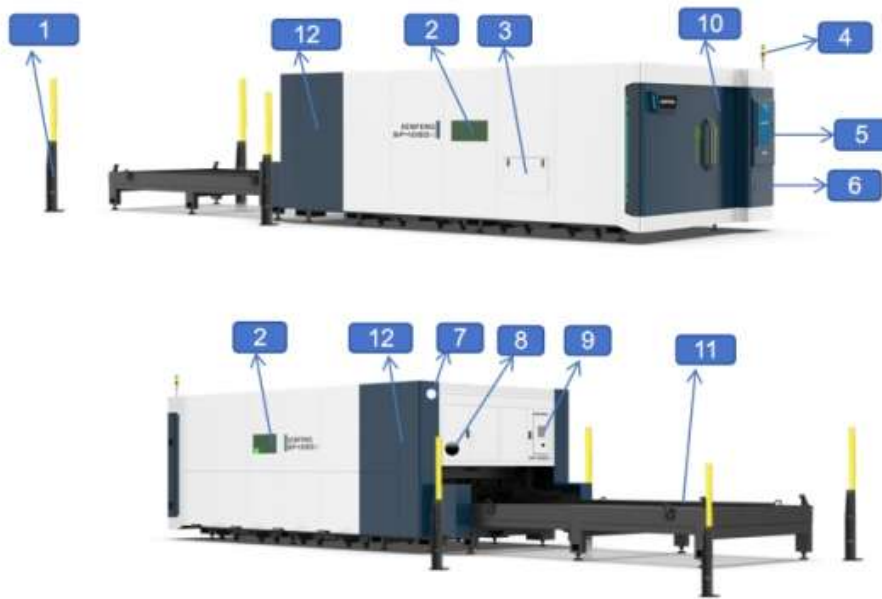
Global General: Users shall provide laser safety training for operators, clarify job responsibilities, and ensure that personal protective equipment (gloves, safety shoes, goggles, etc.) is available at any time.

Germany: A laser safety officer must be appointed. The training shall comply with DGUV Regulation 11 (formerly BGV B2), and training can be obtained through institutions such as the Employer's Liability Insurance Association for the Precision Machinery and Electrical Engineering Industry in Germany.

United States: For Class 3B/4 laser systems, a laser safety officer must be appointed. The training shall comply with the ANSI Z136.1 standard, and training courses can be obtained by contacting the Laser Institute of America (LIA).

3. Product Structure and Installation

The 3015H CNC Laser Cutting Machine is mainly composed of two parts: the mechanical part and the electrical control part. The mechanical part includes the machine tool main body, beam part, Z-axis part, etc. The electrical part consists of the control system, laser, chiller, exhaust fan, etc. Except for the exhaust fan, all the above parts have their own user manuals or operation instructions. Here, the main structure and composition of the main machine part and the electrical control system are described in detail. For the rest, please refer to the respective manuals of each part. The equipment schematic diagram is as follows:



1.Safety light curtain (optional).	7.Camera.
2.Observation window.	8.Main Switch.
3.Maintenance window.	9.Air Conditioner for Electrical Distribution Box.
4.Equipment operation status indicator light.	10.Safety Door.
5.Emergency stop button.	11.Exchange Platform.
6.Emergency stop button.	12.Maintenance Door.

3.1 Mechanical Part

3.1.1 Machine Tool Bed

The machine bed is made of high-strength steel welded structure. It undergoes annealing to eliminate internal stress, followed by rough machining, vibration aging, semi-finishing, vibration aging, and finishing. The internal stress is eliminated

thoroughly, which reduces the deformation of the machine tool and ensures that the precision of the machine tool is maintained for a long time.

3.1.2 Beam Part

The beam part is made of high-strength alloy. Its processing flow is as follows: rough machining → vibratory stress relief → semi-finishing → vibratory stress relief → finishing. High-quality linear guides are mounted on the beam. The Z-axis slide realizes reciprocating movement in the X direction. During the movement, the stroke is controlled by soft limit switches, which provide protection. In addition, there are power-off limit stops and elastic buffers at both ends, ensuring the safety of the system operation.

3.1.3 Z-Axis Device

The Z-axis device is the part that realizes the lifting movement of the cutting head. The lifting movement of the cutting head is completed by the CNC system controlling the servo motor to drive the Z-axis slide plate to reciprocate up and down. Proximity switches are used at both the upper and lower ends to control the stroke.

3.1.4 Exchange Platform Device

The exchange platform device is the part that realizes the reciprocating exchange movement of the workbench. The operation of the cutting platform is completed by the CNC system controlling the motor to drive the chain movement, and the connecting block on the chain pulls the pull block and the cutting platform to reciprocate back and forth. A proximity switch is used at the front end to control the stroke, thereby controlling the speed and position.

3.2 Electrical Control Part

The electrical control system of the 3015H CNC laser cutting machine is mainly composed of a CNC system, a servo system, and a low-voltage electrical system. The servo system consists of AC servo motors and drivers, which are stable and reliable, with good dynamic performance and strong load-carrying capacity. For specific electrical details, please refer to the equipment electrical drawings.

3.2.1 Electromechanical Connection Between Unit Structures and Fault Alarm System

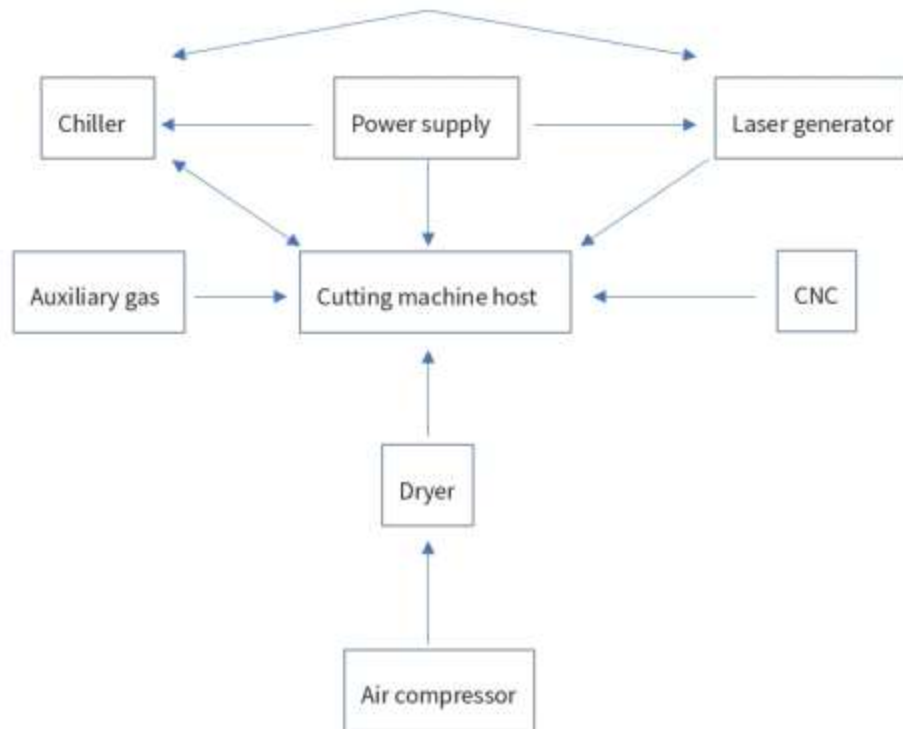


Figure3.2.1-1: Unit Structure Connection Diagram

As shown in the above figure, all parts of the machine tool are closely connected and complement each other: the regulated power supply provides high-quality power for the chiller, laser, and main machine; the chiller provides cooling for the laser and main machine; other parts of the machine tool all serve the cutting machine main body and are powerful guarantees for the normal processing and operation of the main body (the laser-specific air compressor is not a standard configuration).

The electrical circuits of various parts are provided with overcurrent protection by air switches, etc.; each axis direction is equipped with mechanical limit, electrical software limit, and hard limit protection. The electrical hardware limit can cut off the axis power, stop the machine tool operation, and trigger an alarm. The mechanical limit ensures the equipment safety and the personal safety of operators in case of accidents; the system itself is also equipped with motor overload and

over-temperature protection. For the alarm prompt list, please refer to the system manual.

3.2.2 Gas Circuit System

The gas circuit of the laser cutting machine consists of two parts: one part is the cutting gas supplied to the cutting head, including clean and dry compressed air, high-purity oxygen, and high-purity nitrogen; the other part is the auxiliary gas, which is used to assist the operation of various pneumatic components of the equipment. All gases used are clean and dry compressed air.

3.2.3 Water Circuit System

The water circuit system of the laser cutting machine also includes two parts: one part of the cooling water flows from the chiller unit into the laser, cools the laser through the radiator inside the laser, and then returns to the chiller unit; the other part of the cooling water cools the cutting head of the optical path system. Regular replacement and maintenance are required depending on the quality of the added water. In cold seasons, antifreeze must be added according to the local temperature.

3.2.4 Oil Lubrication System

The oil lubrication system of the laser cutting machine is composed of an automatic oil pump and pipelines. The oil pump's oil injection interval is 4 hours of operation, and each oil injection time is 10 seconds (adjustable). The oil level must be checked and refilled every month.

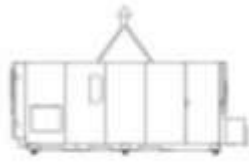
4. Equipment Installation and Commissioning

4.1 Equipment Installation and Transportation

4.1.1 Hoisting and Handling of the Machine Tool

a. The machine tool is equipped with hoisting holes for hoisting. The positions of the hoisting holes are shown in the figure below:

Machine tool lifting figure



Caution

1. Carefully check the safety of harness before lifting, lifting point must be at least 2.3 meters above the machine.
2. Lifting operations must be done by professionals, any other person must stand clear of the danger zone.

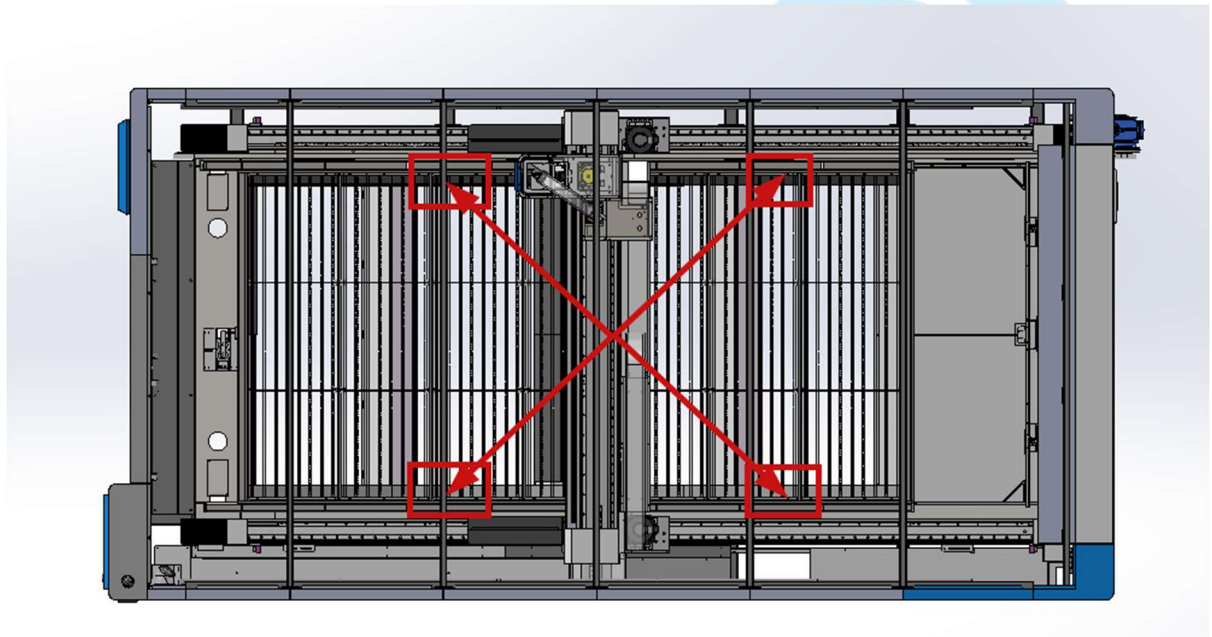


Figure 4.1.1-1 Lifting Points

b. The machine tool can also be moved using a forklift. The position of the forklift is shown in the figure below:

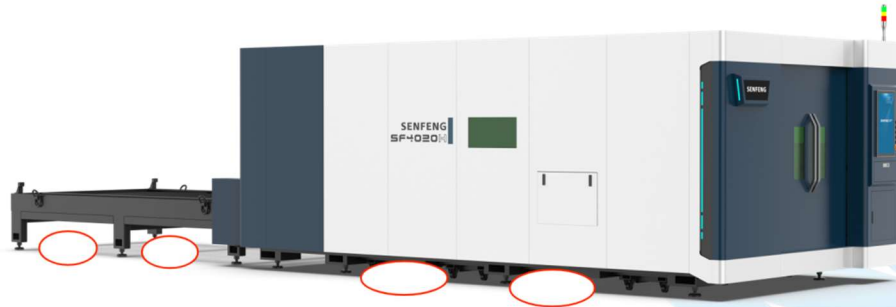


Figure 4.1.1-2: Forklift Position

Note: When using a forklift, the forklift tines must be inserted on the side of the machine without the drag chain. Insertion on the side with the drag chain is strictly prohibited to prevent damage to the drag chain and internal cables/optical fibers. During lifting, avoid supporting the sheet metal parts; instead, select the load-bearing sections of the machine bed as the lifting points.

4.1.2 Auxiliary Transportation Tools

Tool Name	Specification Requirements	Purpose
Crane	Lifting capacity \geq total weight of the equipment, equipped with locks and oval suspension links (For more detailed information, please refer to the technical scheme)	Unloading the machine (from the truck to the ground)

Tool Name	Specification Requirements	Purpose
Gantry Crane / Armored Rollers	1 steerable, 2 fixed, load-carrying capacity \geq total weight of the equipment (For more detailed information, please refer to the technical scheme)	Transporting the machine from the unloading point to the installation position
Hydraulic Lifting Jack	Height adjustable range \leq 30mm, at least 2 pieces	Machine positioning and leveling
Forklift / Pallet Truck	Load-carrying capacity \geq 1 ton	Transporting laser equipment, process coolers, and other auxiliary components

4.1.3 Unloading Process

1. Inspection Upon Arrival:

After opening the package, please confirm whether it is the product you purchased.

2. Check whether the product is damaged during transportation.

Check whether all components are complete and free from damage against the list.

If there are issues such as inconsistent product models, missing accessories, or transportation damage, please contact our company promptly.

3. Machine Unloading:

a. Use a crane to lift the machine from the truck. The lifting points must comply with the equipment manual. Lifting only the front part of the machine is prohibited.

b. Place the machine on the armored rollers, keeping the distance between the

bearing plate and the ground $\geq 100\text{mm}$, and transport it to the vicinity of the installation position.

c. When transporting with a forklift, the tilt angle shall be $\leq 10^\circ$. Place a protective pad at the bottom and fix it with a transport belt. The front rollers are prohibited from touching the bottom plate of the laser equipment.

4.2 Requirements for Installation Site

A maintenance space of 1m shall be reserved around the equipment. The equipment shall be installed based on the foundation soil according to its dimensions (see the foundation drawing for details).

4.2.1 Space and Ground

1. Ground Flatness:

Foot Support Area: Maximum deviation of 3mm per 1 meter.

2. Ground Quality and Load-Bearing Capacity:

Equipment Load-Bearing Requirement: Minimum thickness of concrete is 150mm (see the foundation drawing for details).

Example:

Equipment Model	Length × Width × Height	Weight
3015H	8453*2270*2350mm	5433kg
4020H	10932*3191*2410mm	8168kg
6015H	14612*2270*2350mm	8756kg
6020H	14982*3191*2410mm	10934kg
6025H	14830*3781*2410mm	12294kg
8025H	19005*3781*2410mm	15658kg

12025H	27790*3781*2410mm	22392kg
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4.2.2 Environmental Conditions

Machine Status	Ambient Temperature	Relative Humidity
Operation	10°C~35°C	30%~60%
Storage	-10°C~40°C	30%~60%
Transportation	-20°C~50°C	30%~70%

Avoid exposing the equipment to direct sunlight. Ensure good air circulation in the workshop to prevent condensation (control temperature and humidity with reference to the dew point chart).

Avoid vibration sources (such as forklifts, punch presses) around the equipment. The vertical vibration acceleration shall be $\leq 0.01g$ (100mm/s^2). If the vibration is excessive, shock-absorbing pads must be installed.

When the ambient temperature is lower than 10°C, the efficiency of the cooling system will decrease; when the temperature is higher than 35°C, the efficiency of the cooling system will also decrease, and the electrical components will have a significant temperature rise.

When the ambient humidity is lower than 30%, the environment is dry and prone to static electricity; when the humidity is higher than 60%, electronic components (circuit boards, interfaces) are prone to moisture and short circuits.

4.3 Energy and Medium Supply

4.3.1 Power Supply

1. Rated Voltage:

50Hz: 380V±10% (short-term fluctuation), long-term operation shall be stable within ±5% of the rated value.

60Hz: 380V±10% (short-term fluctuation), long-term operation shall be stable within ±5% of the rated value (some accessories need to be changed).

2. Power Consumption:

For specific machine models, please refer to the technical proposal.

Laser Power	Maximum Power Consumption (100% Laser Power)
1.5kW	Approximately 10kW
3kW	Approximately 20kW
6kW	Approximately 30kW

4.3.2 Cutting Gas Supply

4.3.2.1 Gas Purity and Consumption:

Cutting Gas	Purity Requirement	Standard Pressure Cutting Consumption (m ³ /h)	High-Pressure Cutting Consumption (m ³ /h)	Gas Flow
Oxygen (O ₂)	99.95% (Grade 3.5)	10 (Nozzle Ø1.7mm, Pressure 6bar)	20 (Nozzle Ø1.7mm, Pressure 12bar)	Approx. 25 ltr/min

Cutting Gas	Purity Requirement	Standard Pressure Cutting Consumption (m ³ /h)	High-Pressure Cutting Consumption (m ³ /h)	Gas Flow
Nitrogen (N ₂)	99.999% (Grade 5.0, Recommended)	/	90 (Nozzle Ø2.7mm, Pressure 20bar)	Approx. 50 ltr/min
Compressed Air (Optional)	Complying with ISO 8573-1 Grade 4 (Dust-Free, Oil-Free, Condensate-Free)	/	Approximately 60 (Nozzle Ø5mm, Pressure 5bar)	Approx. 50 ltr/min

4.3.2.2 Connection Point Pressure:

Oxygen (Standard Pressure): Input pressure \geq 8bar (116psi), maximum static pressure 21bar (305psi).

Nitrogen (High Pressure): Input pressure \geq 20bar (290psi), maximum static pressure 30bar (440psi).

4.3.2.3 Compressed Air Supply

1.Parameter Requirements:

Pressure: 7.5~16bar (110~230psi). The pressure of the equipment auxiliary gas is 6~8bar (90~120psi), and the minimum pressure during cutting is 7.5bar (110psi, Nozzle Ø3mm).

Consumption: Average approximately 28m³/h (16.5cfm), maximum approximately 60m³/h (35.4cfm) (for 6kW and below).

Quality: Complying with ISO 8573-1 Grade 4 (Dust: \leq 40µm, Oil: \leq 5mg/m³, Condensate: Dew Point \leq +3°C).

2.Pipeline Requirements:

The diameter of the main loop \geq 1 inch (26mm), and the length of the pipeline from the loop to the machine connection point \leq 5 meters.

A manual 3/2 directional valve/ball valve shall be installed on the pipeline, and the exhaust port shall be located in front of the machine input end.

4.3.3 Cooling Water Supply

Cooling Water: High-quality purified water, distilled water, or deionized water.

The chiller unit shall be placed stably and kept at a certain distance from the wall. Sufficient space for air inlet and outlet shall be reserved at the chiller installation position to prevent poor heat dissipation of the chiller. See the chiller manual for details.

When the ambient temperature is lower than 0°C, high-purity ethylene glycol antifreeze/laser-specific antifreeze must be added. Mixing ratio: 30% for -15°C; 40% for -24°C.

4.3.4 Installation of Dust Collection Device

The connection port of the dust collection fan is shown in the figure below: The dust collection pipeline shall not be too long. For other requirements, the dust collector model must be reselected (see 2.4.5 for details).



4.4 Installation and Commissioning

To be carried out by Senfeng's own service personnel or authorized service personnel of Senfeng.

The commissioning of the machine tool requires professional personnel and must be strictly implemented in accordance with relevant regulations. Before

commissioning, please first understand the performance of the machine tool and read the relevant accompanying technical materials. Correct commissioning is the basis for ensuring the normal operation of the machine tool. If you have any questions, please contact us promptly, and we will give you a satisfactory reply as soon as possible.

4.5 Daily Operation Process

4.5.1 Preparation Before Startup

Environmental Inspection:

Confirm that there are no obstacles in the work area, the safety passage is unobstructed, and the ground is free of oil stains and water accumulation.

Check that the ambient temperature and humidity meet the requirements (refer to Section 4.2.2) and that there is no direct sunlight on the equipment.

Equipment Inspection:

Appearance Inspection: Check that the safety cabin door and observation window are not damaged, the warning signs are clear and complete, and the electrical cabinet door is locked properly.

Safety Device Inspection: Test the emergency stop button (the equipment shall be powered off and the axis shall stop immediately after being pressed), check the safety door interlock (the laser beam shall be turned off when the safety door is opened), and ensure that the light curtain (if any) is not blocked and functions normally.

Medium Inspection: Check that the cutting gas pressure is normal (oxygen \geq 8bar, nitrogen \geq 20bar), the compressed air pressure \geq 7bar, the cooling water level is normal (the liquid level gauge shows between "MIN" and "MAX"), and the preservative/antifreeze is added in accordance with the requirements.

Material Preparation:

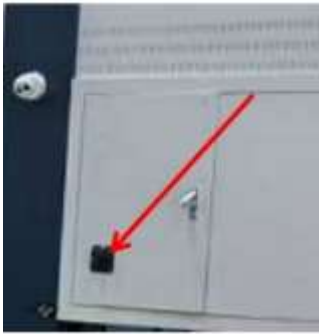
Confirm that the workpiece material meets the equipment requirements (only metal materials such as low-carbon steel, stainless steel, and aluminum are allowed;

cutting of plastics, wood, PVC foil, etc. is prohibited), the workpiece size \leq the equipment processing range (refer to the equipment parameters), and the surface is free of impurities.

Check the flatness of the workpiece (hot-rolled plates comply with DIN EN ISO 9444-2, cold-rolled plates comply with DIN EN 10131). Deformed workpieces must be corrected before use.

4.5.2 Startup Operation

1. Connect the factory power supply.
2. Activate the main power of the equipment.



3. Turn on the servo control knob and the 24V control knob on the wiring box.
4. Turn on the equipment chiller.



5. Turn on the operating system.
6. Power on the laser.
7. Complete the preparation work after startup.

4.5.3 Processing Parameter Setting

1. Select Process:

Click "Process" on the control panel and select the processing program matching the workpiece material and thickness (such as "Low-Carbon Steel - 2mm - Oxygen Cutting"). If custom parameters are required, the operation must be performed by authorized personnel.

2. Process Parameter Adjustment:

Cutting Gas: Select according to the material (oxygen for low-carbon steel, nitrogen for stainless steel) and set the gas pressure.

Laser Power: Adjust according to the material thickness (e.g., 800W for 2mm low-carbon steel, 1500W for 5mm stainless steel). Exceeding the rated power of the equipment is prohibited.

Cutting Speed: Match according to the laser power and material thickness (e.g., 3m/min for 2mm low-carbon steel, 1.2m/min for 5mm stainless steel). Excessively high speed may result in incomplete cutting, while excessively low speed may cause excessive dross.

3. Test Cutting (For First-Time Processing or Material Replacement):

Select on the control panel, set the test cutting path (such as a 100mm×100mm rectangle), and click "Start Test Cutting".

During the test cutting process, observe the cutting quality (such as smooth cut, no dross, no burrs). If the quality is poor, adjust the parameters (such as reducing the speed, increasing the gas pressure) and perform the test cutting again.

4. Formal Processing:

After the test cutting is qualified, select "Formal Processing", confirm that the processing path is correct, and click "Start".

During the processing, if an abnormality occurs (such as abnormal noise, excessive sparks), press the emergency stop button immediately.

4.5.4 Shutdown Operation

1. After Processing:

After the processing is completed, the equipment will automatically turn off the laser beam. Keep the dust removal system running for 5~10 minutes (to remove residual dust).

2. Turn Off Auxiliary Systems:

Turn off the laser equipment.

Turn off the nozzle cooler, turn off the dust removal system, and close the compressed air and cutting gas supply valves.

3. Cut Off Power Supply:

After confirming that all systems are turned off, turn off the main switch. If the equipment will not be used for a long time, lock the main switch.

4. Clean the Work Area:

Clean the oil stains and dust on the workbench and ground, organize tools and workpieces, and fill in the equipment operation record (processing time, materials, fault conditions, etc.).

5. Maintenance, Servicing and Troubleshooting

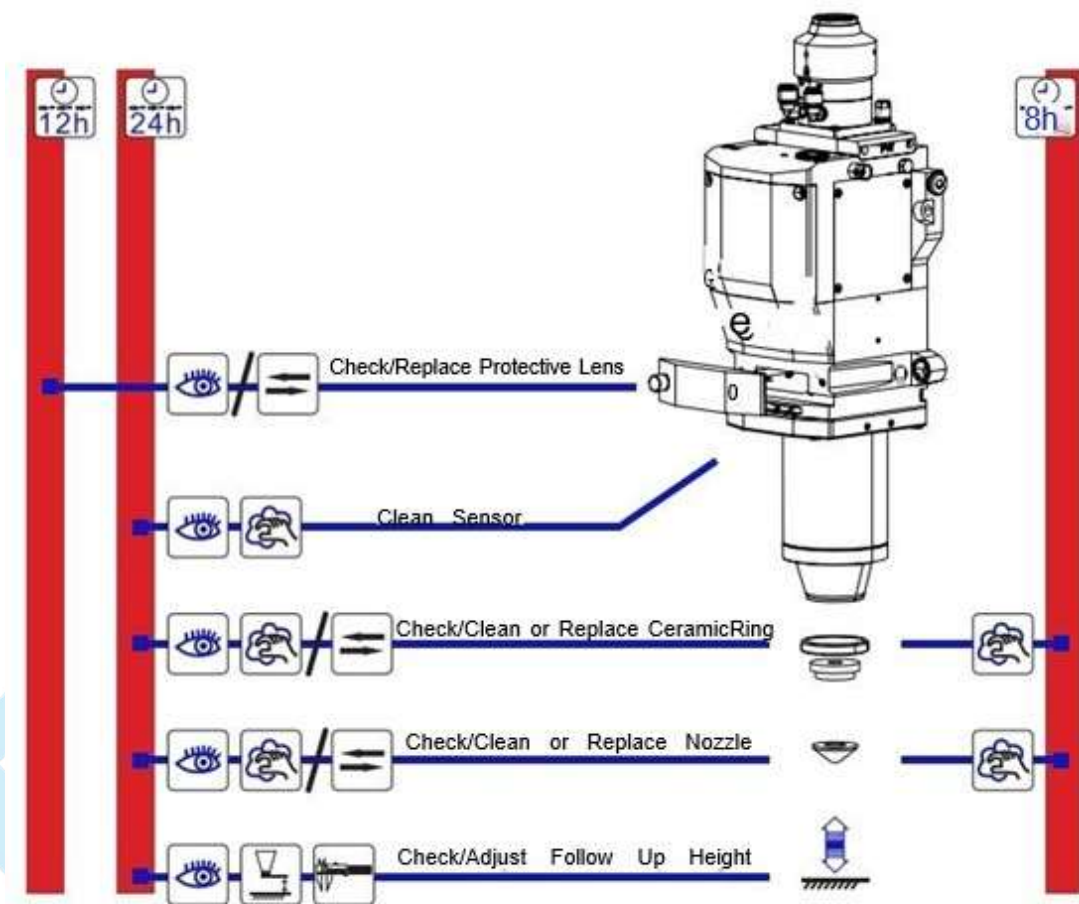
5.1 Maintenance and Servicing

1. Daily Equipment Maintenance (Before/After Daily Operation)

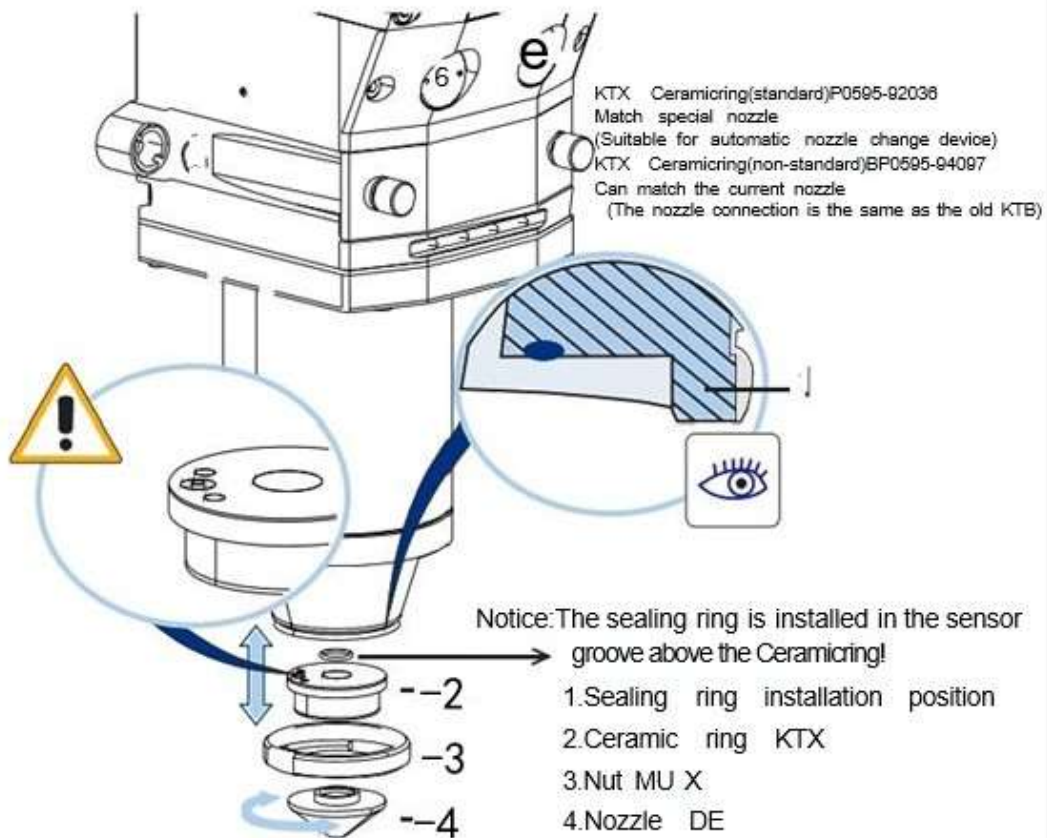
Maintenance Item	Maintenance Content	Standard Requirements
Safety Device Inspection	Emergency Stop Button: The equipment shall be powered off and the axis shall stop after being pressed.	Functions normally without jamming.
Observation Window/Observation Mirror: No scratches, damage, clean and free of stains.	Good light transmission without obstruction.	
Medium Inspection	Cutting Gas Pressure: Oxygen \geq 8bar, Nitrogen \geq 27bar.	Pressure within the normal range.
Compressed Air Pressure \geq 7bar.	Stable pressure without leakage.	
Cooling Water Level: Between "MIN" and "MAX" on the liquid level gauge.	Normal water level without turbidity.	
Equipment Cleaning	Workbench: Clean residual dross and oil stains.	Flat table surface without debris.
Electrical Cabinet Ventilation Port: Clean dust and ensure no blockage.	Good ventilation without debris.	

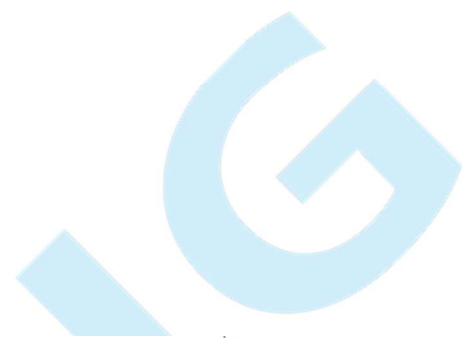
2. Daily Maintenance of the Cutting Head

Cutting Head Daily Maintenance Items

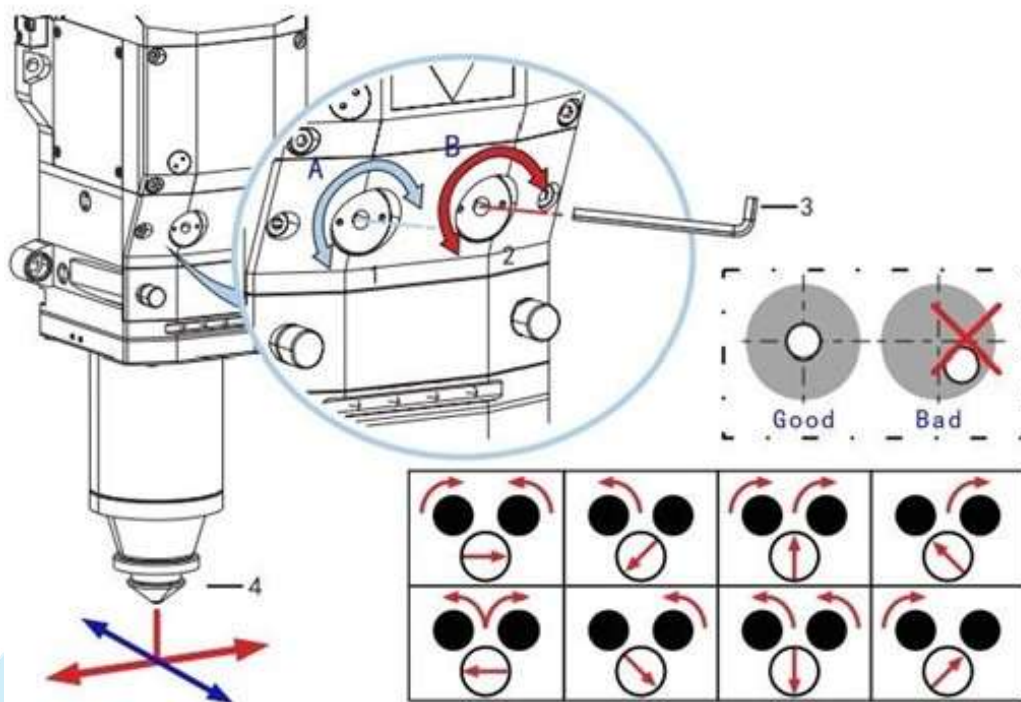


Replace Ceramic Ring And Nozzle





Coaxial Adjustment

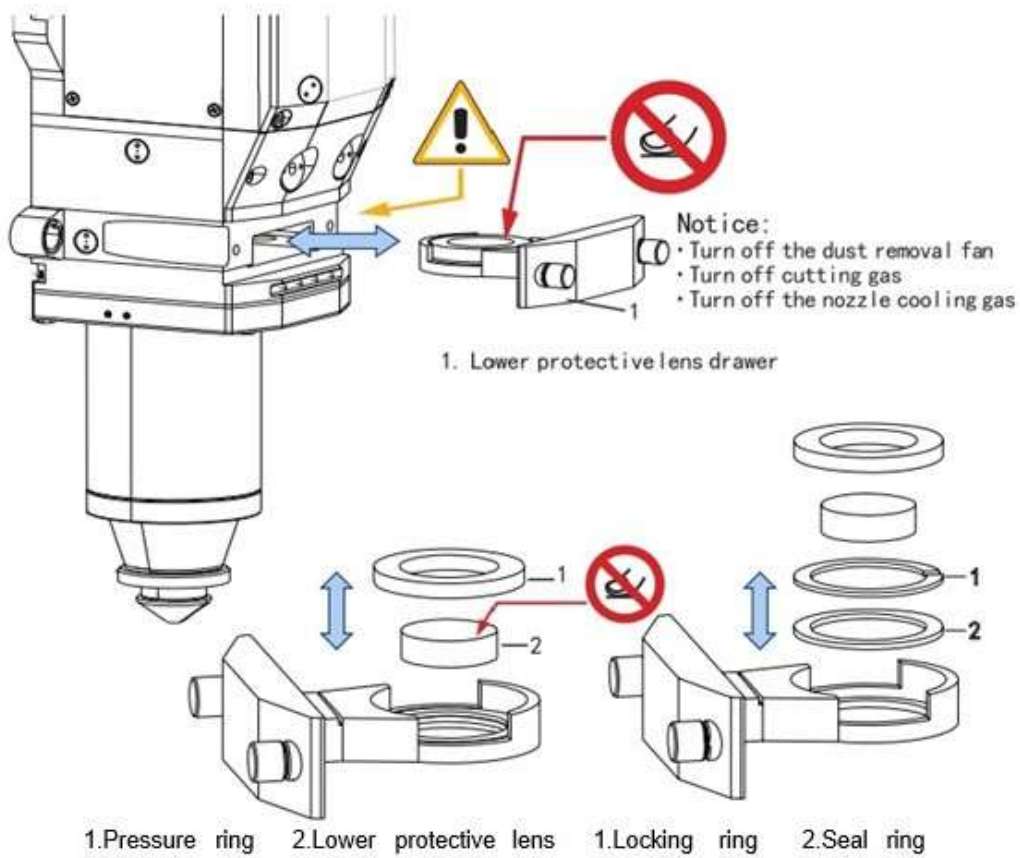


Debugging: laser beam-spot position, focusing lens

- 1. Adjusting screw A
- 2. Adjusting screw B
- 3. Hexagonal screw wrench (size 4mm)
- 4. Nozzle DE (Nozzle Electrode)

The user positions the laser beam to the center position through two adjustment screws (1, 2)
 Adjustment range: $\pm 1.5\text{mm}$ Adjustment tool: Hexagonal screw wrench (size 4mm)

Protective Lens Drawer Daily Maintenance



For more details, please refer to the "Senfeng Fiber Laser Cutting Machine Maintenance Manual".

5.2 Fault Analysis and Troubleshooting Methods

5.2.1 Issues with the Follow-Up System

a) Alarm and Abnormality Analysis

1.Upper/Lower Limit Active

When the system detects that the upper limit or lower limit photoelectric switch or contact sensor of the Z-axis is active, this alarm is generated. In this case, the following situations should be focused on:

Whether the limit signal line is connected normally.

Whether the "Limit Signal Type" parameter is set correctly. The limit signal can be set to normally open or normally closed.

Whether the upper/lower limit actually senses an object and outputs an effective level signal.

Whether the sensor is damaged, or contaminated with oil stains or dust.

2.Exceeding Z-Axis Stroke

When the Z-axis coordinate of the system is greater than the set stroke, this alarm is generated. If a false alarm occurs, it is necessary to check whether the system is reset correctly, whether the stroke parameters are set correctly, and whether the encoder feedback is normal.

3.Upper Limit Always Active

When the system returns to the origin, touches the negative limit, and then moves back but cannot exit the negative limit area, this alarm is generated.

4.Servo Alarm

When the system detects that there is a servo alarm signal input at the 14th interface of the servo interface, the system will generate a servo alarm. The following

reasons may cause the servo alarm on the height adjuster:

Servo motor alarm: Check the servo motor drive to see if there is an alarm. If so, power it on again.

5.No Encoder Response

When the system sends out an analog signal but detects no change in the encoder signal, this alarm is generated. The reasons for this alarm include:

Poor line contact, the analog signal is not sent to the servo, or the zero-speed clamping signal is always active, or the encoder feedback signal is not correctly connected back to the height adjuster.

5.2.2 Other Fault Information and Troubleshooting

Fault Phenomenon	Cause Analysis	Troubleshooting Method	Remarks
No auxiliary gas output during part processing	<ol style="list-style-type: none"> 1. Insufficient gas pressure; 2. Incorrect gas channel selection; 3. Solenoid valve damage or no control voltage output. 	<ol style="list-style-type: none"> 1. Check the gas circuit pressure; 2. Check whether the gas channel in the process parameters is correct; 3. Check the solenoid valve and related circuits. 	
Abnormal noise during axis operation	<ol style="list-style-type: none"> 1. No lubricating oil in the axis moving parts; 2. Interference between moving parts and fixed parts. 	<ol style="list-style-type: none"> 1. Add lubricating oil; 2. Check the safety of the running path of the moving parts. 	
No laser or insufficient laser power	<ol style="list-style-type: none"> 1. CNC signal not sent; 2. Dirty or damaged protective lens; 3. Damaged or 	<ol style="list-style-type: none"> 1. Check whether the connection between the CNC console and the laser machine is correct; 2. Check the protective lens; 3. Replace the nozzle; 	

Fault Phenomenon	Cause Analysis	Troubleshooting Method	Remarks
	<p>blocked nozzle; 4. Incorrect optical path; 5. Laser alarm.</p>	<p>4. Adjust the laser optical path; 5. Turn off the laser and restart it / If the temperature of the laser chiller is too low, wait until the temperature reaches the required value and then restart the laser.</p>	
<p>Processed pattern inconsistent with drawing dimensions</p>	<p>1. Incorrect program input; 2. Influence of positioning accuracy; 3. Damaged servo motor; 4. Damaged servo driver.</p>	<p>1. Check the program against the drawing; 2. Check the machine tool accuracy; 3. Send the servo motor and servo driver for inspection and replace if damaged.</p>	
<p>Floating Head Alarm</p>	<p>1. Loose connections of the amplifier, etc.; 2. Loose nozzle or magnetic ring; 3. System problem; 4. Damaged nozzle or iron dross on it.</p>	<p>1. Tighten the connections; 2. Tighten the nozzle or magnetic ring; 3. Recalibrate the floating head; 4. Replace or clean the nozzle.</p>	
<p>Motor Alarm</p>	<p>1. Motor not powered on; 2. Motor alarm.</p>	<p>1. Power on the motor and clear the alarm; 2. Check the alarm information on the servo driver (refer to Driver Operation Manual), power off the motor and restart it to clear the alarm. If the alarm occurs repeatedly, please contact us.</p>	

6. Equipment Dismantling and Disposal

6.1 Preparation for Dismantling

Personnel Requirements: Dismantling must be carried out by Senfeng, Senfeng-authorized service personnel, or professional disposal companies. Operators must have equipment dismantling qualifications and be familiar with safety specifications.

Environmental Preparation:

Seal the dismantling area, set up warning signs, and prohibit unauthorized personnel from entering.

Clear obstacles around the equipment to ensure the transportation route is unobstructed.