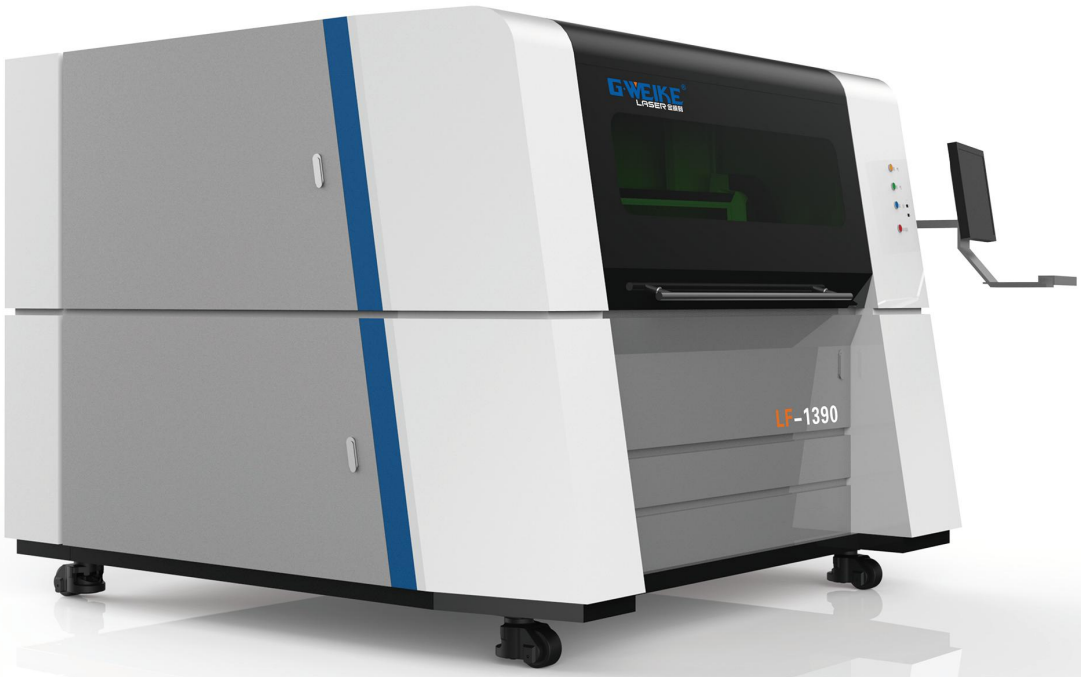
G·WEIKE® LASER

USE GUIDE MANUAL

LF1390

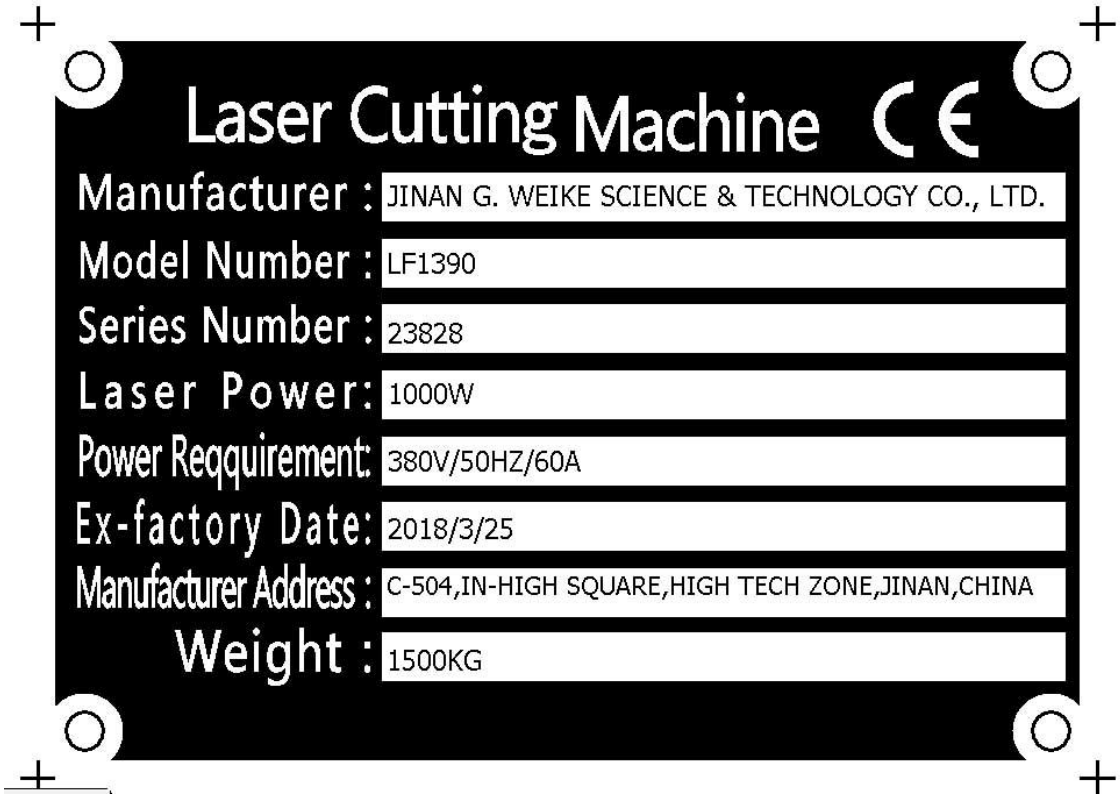


FIBER LASER METAL CUTTING MACHINE

VER 1.0

JINAN G. WEIKE SCIENCE & TECHNOLOGY CO., LTD.

LF1390-23828-UGM
DATE OF APRROVAL:SEPTEMBER 14TH,2018


Laser Cutting Machine CE
Manufacturer : JINAN G. WEIKE SCIENCE & TECHNOLOGY CO., LTD.
Model Number : LF1390
Series Number : 23828
Laser Power: 1000W
Power Reqquirement: 380V/50HZ/60A
Ex-factory Date: 2018/3/25
Manufacturer Address : C-504,IN-HIGH SQUARE,HIGH TECH ZONE,JINAN,CHINA
Weight : 1500KG

Jinan G.Weike Science & Technology Co.,Ltd

Preface

Thank you for you choose our company products. We will provide you with perfect after-sales service and solutions, please properly save the specification and other accessories, so that you can better use.

This specification is only applicable to the standard configuration of our products, for special customized products, please read the attached notes carefully.

This operating manual is for the user and operator of the machine tool, but also for the maintenance of personnel. This manual with a safetytip, for your personal safety, must be carefully read before the use ofthe second chapter on security.

To quickly and effectively use the product, we requires the operator to have the following conditions:

First: the operator have to know computer expertise, could use the relevant editing graphics software, such as: Photo-shop,Auto-cad, Coreldraw and other graphics software.

Second: the operator has a certain knowledge of Optics and related mechanical and electrical equipment maintenance and maintenance knowledge.

Third: to confirm whether the device is familiar with the operation of the equipment before the operation process and can operate according to the equipment.

As the function of the product is constantly updated, the products you receive may differ in some respects from the statements in this manual. This user manual can satisfy the basic demands of installation and adjustment, more details please refer the user manuals of the machine .Any distribution please contact with our engineers parts and apologize for this.

CATALOGUE

Chapter 1 Safety Instructions and Precautions

1.1 Overview

Before operate machine and do daily maintenance, operator must read this chapter carefully, with learn safety measures and requirements of machine, and comply with the relevant safety precautions.

1.2 The machine safety standards

Laser processing equipment and operation shall be in accordance with user guide EN ISO 12100:2010,EN 60204-1:2006+A1:2009+AC:2010,EN ISO 11553-1-2008 BS EN 60825+4:2006+A2:2011 laser products radiation safety, equipment classification requirements laser equipment and facilities' electrical safety of those standards .

1.3 Safety identification

Warning

This manual is only suitable for G.WEIKE laser cutting machine. Beside the regulations in this manual, other non-standard operations may also lead to radiation injury on users.

Safety and safety protection, safety signs and instructions for use before and during use.

Identification	Description
	**Warning :Laser radiation** This label aims to warn user that there is a great risk of getting laser radiation
	**Warning: Electric shock** This label aims to warn user that there is a great risk of getting electric shock.
	**Warning: Hands pinching** This label aims to warn user that in this place the door may pinch your hands.

	**Warning: Be care of the high temperature** The laser head will produce a high temperature in its surface, please don't touch the laser head when its working or shortly after its working.
	**Warning:Be care of the low temperature** When using the liquid nitrogen to cutting the materials ,the user's hand may hurt by the lower temperature gas tank .Please wear the gloves when connecting the gas tank with the machine
	**Warning**: It's not allowed to open the door ,put your hands body into the moving area during machine running process

1.4 Security management warning

a). Specify the security administrator, determine scope of their duties, and **laser processing operator must get safety education and read the use guide manual**.

b). Specify laser safety management area, set up warning card in the management area's entrances and exits, content including: power of laser machine, laser type, not allowed to enter, protect eyes and security manager's name, etc.

c). Our company would undertake a training activity(face to face or training on the Internet) to the customer. **Operator of laser processing machine, must receive special training, to reach a certain level, and on the premise of security administrator agree, then operate the machine**.

1.5 Laser safety notice

The laser source of this machine is belong to **4 class** laser.The main harm to human body are the eyes and skin, laser light to any part of the human body can cause burns.**Especially long time watching fiber laser will cause the retina serious damage to the eyes! Avoid to put any parts of the body in flight path of laser equipment**, in order to avoid damage due to incorrect operate.

1.6 Eyes and skin's protection

	**Caution :When the machine's door is open in processing.All operators must be strictly wear 1064 nm laser protective glasses!(the model can choose SD - 4) Don't wear glasses for operation and observation prohibited!**,

1.7 Fire and high temperature protection

a).Fire protection of laser cutting processing, often use oxygen, and spark cutting the splash, oxygen is easy to cause the danger of fire. So there should be no inflammable and explosive articles of the workspace, and the corresponding prevention facilities. Please close the machine's door when processing the materials.

b).Don't put inflammable materials in the waste bunker.

c).Please put a fire extinguisher in the designated spot. Please refer picture 3-2.

	**Caution: Must wear protective gloves.** As the laser cutting process will generate a lot of heat please wear gloves and wait 5-10 minutes after the laser machine stop working to touch the materials and laser head.

1.8 Electric safety

	**Warning :**Don't use wet hand contact with any electrical safety switch in order to avoid electric shock. Machine parts with lightning signs, says these areas have high voltage electrical appliances or electrical components, the operator when close to these areas or open should take care all the more, in order to avoid electric shock. For example, the shield, machine tool servo motor position transformer cabinets, electrical cabinet, etc.

	**Warning:** In the condition of electricity charged in don't to touch the electrical cabinet components, such as: CNC device, servo device, transformer, fan, .etc.

	**Notice:** Comprehensive careful reading machine manual and electric schematic diagram, in order to be familiar with the various functions and the corresponding key operation method.

a). <u>The operator can't repair the electrical parts and laser parts by himself .This machine must be repaired by professional engineers .</u>

b). Don't open the electrical cabinet, prohibit to change the machine parameters has been set. If you need to change, must be approved by equipment manufacturing factory training and obtain the professional operation, and record the changes before the values of the parameters, so that when necessary, can restore the original state.

c). With the laser processing, general power supply voltage for the a few kv to tens of thousands of volts, should prevent laser tube under high voltage and high voltage generated X-ray damage danger.

1.9 Machine protective measures

1) Specified security administrator, determine the scope of their duties, and do safety operation and safety education to the laser processing operator.

2) Specify laser safety management area, set up the warning card in the management area entrances to , content including: the power of laser machine, laser type, not allowed to enter, protect eyes and security manager's name, etc.

3)When not use laser processing machine, should break total power, avoiding cause harm due to wrong operation.

4) Put smoke and dust produced in the process of machining and laser gas emissions through the exhaust pipe to air filter, all gas cylinders should be neat and firm.

	**Note**: Please wear the gas mask when operating then machine or near the processing area or operation area.

1.10 Common sense of operator

a).Operator must receive special training by our company engineer or other professional engineers, to reach a certain level, under the premise of the agreement of security administrator, then can operate.

b).Machine operator or person who close to the laser during use laser, should be put on the appropriate laser protective goggles, and wearing protective clothing, in the area of the wear protective goggles must have good indoor illumination, in order to make sure operator operating smoothly.

c).In order to protect the operator, there must have a processing chamber or protective screen around the set. In the processing room should have protective laser diffusion device to protect operator; When open door of

processing room, laser light brake should be closed.

Chapter 2 Introduction

2.1 Products features

a). Adopt high strong overall welding fuselage, through high annealing, Large CNC gantry milling machine precise process, have good rigidity, stability, aseismicity,etc advantages.

b).Adopt cast aluminum beam, through advanced heat treatment process, have high strong, light weight and good rigidity. etc advantages.

c).Imported high speed linear guide drive running, high accuracy, fast speed, suitable for high accuracy, fast cutting.

d).Fiber laser have high optical quality,high light, high Slew Rate ,maintenance-free, stable and reliable , low operating cost , small volume .etc.

e).The cutting head is equipped with manually adjust the focus,responsive and accurate. Cutting head movable up-down through capacitive sensors to control the motor drive, when cutting, laser focal length (nozzle) relative to the cutting plate distance remains the same, ensure the cutting quality. At the same time, according to the material and thickness of the cutting board, adjust the location of focus, to ensure the cutting quality.

f).Pneumatic components are all adopt high quality components, advanced design, reliable and can be equipped with three different kinds of cutting gas simultaneously and free to choose, the pneumatic system adopts the design of high voltage, when cutting of stainless steel plate, nitrogen pressure up to 1.5 Mpa, guarantee stability of the system, improve reliability of the cutting machine, and ensure cutting surface quality.

2.2 Main purpose and application scope

Laser cutting is a more advanced machining method in cutting materials. LF1390 series fiber cutting machine adopt high quality fiber laser source, equipped with precision linear guide, and other transmission mechanism, optical fiber cutting head, humanized operation interface. It is mainly used for metal crafts, metal products, precision machinery, auto parts and other industries.

Note: This machine is used to cutting metal materials,it can't be used to cutting nonmetal materials such as plastic,acrylic,wood,etc.According to size of laser power you choose, material cutting range is different.

2.3 Use Environmental Conditions

a) Power supply specifications: three-phase four wire system (three lines of fire, a zero line), 50Hz 380V;

b) Power quality: Three-phase imbalance degree<2.5%,

c) Ground protection: Machine grounding, in machine tool side pile ground

d) Wires, and machine tool can be received the power supply ground wire, grounding resistance < 4 Ω.

e) Requires good ventilation, no dust, no corrosion, no pollution's space

environment.

f) Install ground surrounding are not requested have big vibration.

g) Chiller is used for cooling laser, cutting head etc. specialized equipment, and cooling circulating water requires use high quality pure water or distilled water.

h) For prevent fire happen, working place should equipped with suitable fire extinguisher and obligate certain fire channels.

i) The left and back of the machine tool should be away from the workshop wall in more than 1.2 M; around the laser should be in 1.0 M away from the walls.

j) Control unit, servo unit, display and control panel are the core parts of the machine tool, it has certain requirements for the environment, and should avoid machine suffer from electromagnetic interference, such as arc welding and discharge machine, etc., in order to affect the normal work of the machine.

2.4 The impact on the environment and energy

The laser of laser cutting machine belong to fourth class of laser products, its injection beam and diffuse reflection light can cause damage to the human body (especially the eyes), the operator and the present personnel should be paid attention to protection, must be protective glasses, the model can choose SD - 4, specification of 1064 nm.

2.5 Products Construction and working principle

2.5.1 Overall structure and its working principle, working characteristic

LF1390 series fiber cutting machine, the main components are: host machine parts, control system, laser, water chiller, transformer, gas equipment, etc. Host machine parts: host machine parts is the main part of the laser cutting machine, main engine parts consistent of lathe bed, beams, workbench, gas path and water path. Other auxiliary peripherals including water chillers, variable pressure system.

2.5.2 Main component or functional unit of the structure, function and working principle

a Framework

Lathe bed made from Q235 welding, welding using annealing method to eliminate casting stress(thermal aging), and one-off and stress relieving more thoroughly, reduce the deformation of lathe bed, ensure the accuracy of machine tools remain unchanged for a long time

b Beam section

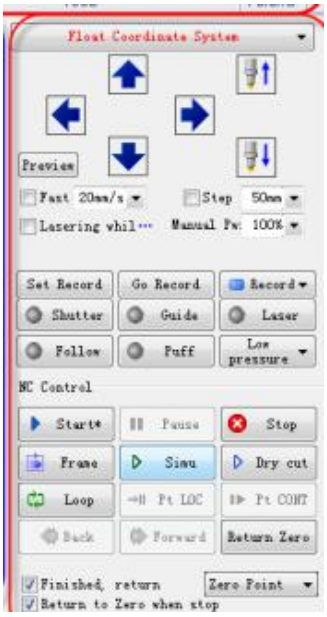
Using aluminum beams, through advanced heat treatment technology, has high strength, light weight, good rigidity, etc.

c Workbench

Work units are overall welding structure, has good strength and stability.

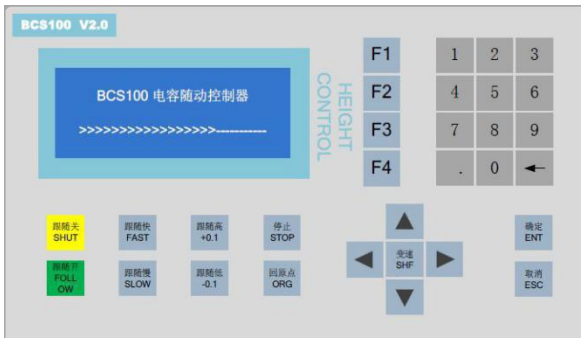
d Electrical control part

Lf1390 series fiber cutting machine's electric control system is mainly composed of servo system, control system, movable system and low voltage electrical system.

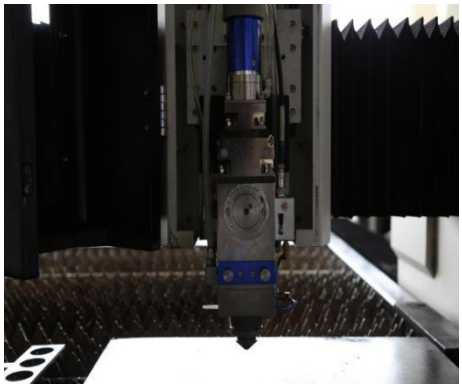


Picture 2-1 Software operating main interface

Picture2-2 servo system



Picture2-3 Calibration operation main interface



Picture2-4 Cutting head

2.6 Function, structure and working principle, working characteristic of the auxiliary device

2.6.1 Gas path system

The gas path of the optical fiber cutting machine is provided with cutting gas (compressed air, high purity oxygen and high purity nitrogen) to the cutting head.

Cutting gas can be divided into oxygen and nitrogen, oxygen is mainly used for cutting ordinary carbon steel; Nitrogen mainly used for cutting

stainless steel, alloy steel and aluminum alloy. User should choose different cutting gas according to different materials. In the cutting gas system, due to installed pressure sensor inside, make sure that machine stop work in time when gas pressure is not enough, avoid the abandonment of cutting parts. The air pressure threshold can be regulated by the upper pressure sensor screw set, cut with compressed air and oxygen can also be adjusted by controlled proportional valve.

2.6.2 Water system

Water chiller of fiber cutting machine's water system adopts double temperature water chiller, one is cooling laser and the other is cooling cutting head.

Note: In order to guarantee normal running of the whole machine and laser, maintain the stability of laser power and laser mode is good, equipment and auxiliary means is extremely important. If the user is unauthorized use that not meets requirements of the machine's water, electricity, gas caused low laser power, bad laser mode and other parts of damage, are not within the scope of the warranty

Chapter 3 Transportation, Shipment and Storage

3.1 Machine tool transportation

- Spare trucks transport to the final installation site, the work must be conducted by users in the preparation and implementation. Must be declared machine in time before delivery to the installation place of course. In particular, to the doorway pillar size, height can use armoured cable bracket height, pavement roller, etc.
- Must consider the scale of the machine tool drawings marked in transit!

Assist and handling tools

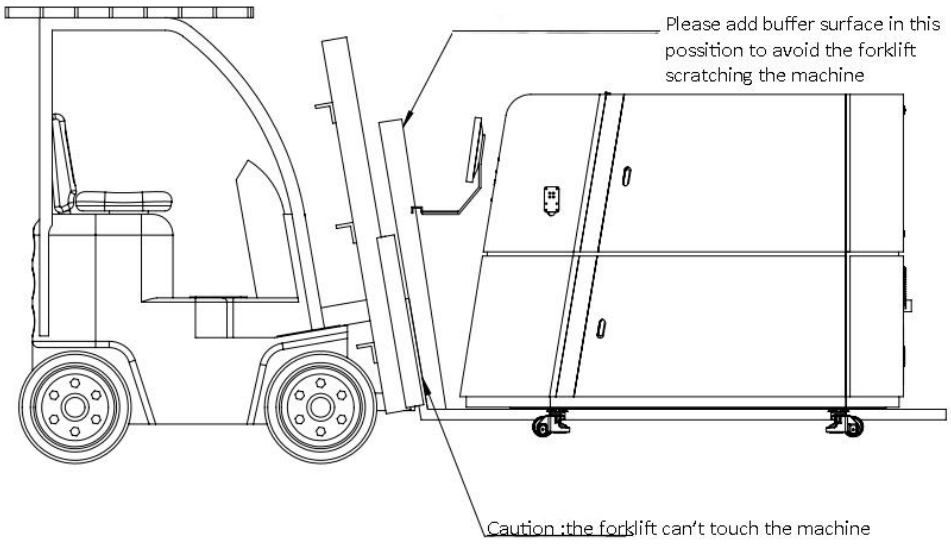
- The user must prepare for the following items:

1. Used for machine tools, laser and additional devices of truck crane. Suggestions for the lifting force for at least 80 t hydraulic crane; If according to the local situation need to use a bigger boom, truck crane must have greater gravity.

2. Forklift (2.5 t) bearing capacity.

3. The bearing capacity of bridge crane: 10 t 4.Armoured roller (1 and 2 can be turned to a solid).

4.At least two lifting force for at least 5 t (30 mm) minimum height adjustable rear: hydraulic jack.



Picture 3-1 Forklift drawings

Note:When the machine are transport to the installation point,the distance between

machine landing leg basement and the ground must always less than 100mm

5.Crow bar (1 m), and extension.

1.Using the pliers to cut off the fixing band.

2.Using the crow bar to unclench the wooden box.

3.2 Delivery check

3.2.1 Attentions of open the wooden case

Please open according to prompt in outside wooden case, in order to avoid to cause damage of the equipment in the cabinet. Please do not use sharp item open the film package of machine and other equipment , avoid cause surface scratches and damage to the electrical installation to protect the pipe, if customer cause damage on its own,is not company's responsible for replacement.

3.2.2 Check the content

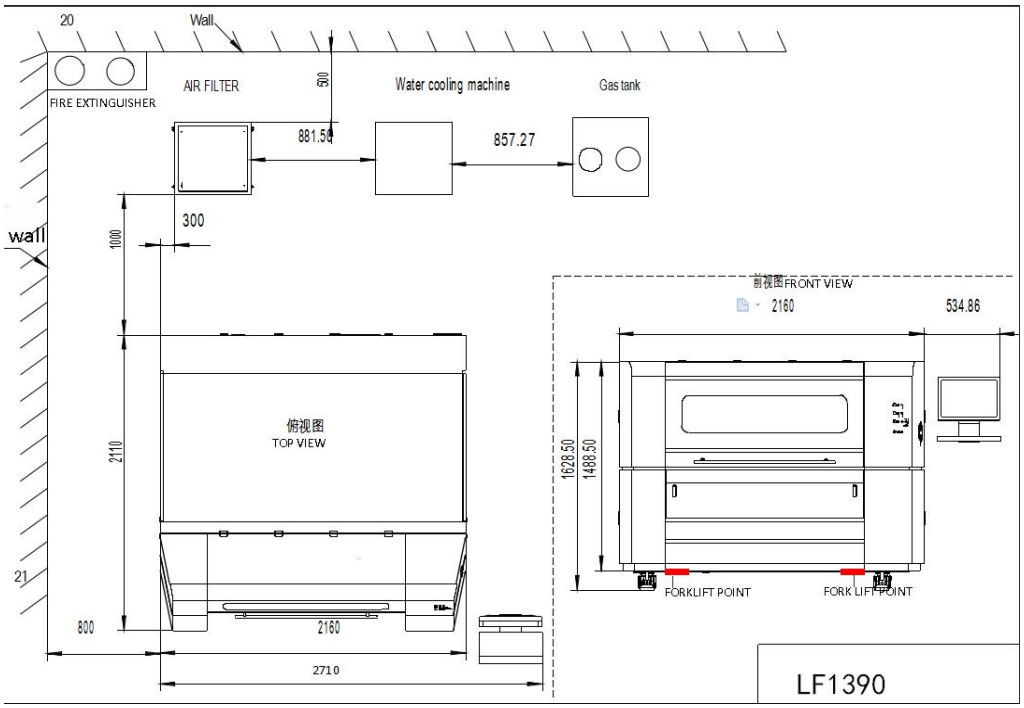
a) After opening the package, please confirm whether the products are you buy ;

b).Check the product if there is damage in transit

c).Confirm whether the parts is complete, or if there is any damage;

If there are inconsistent of model of machine, the lack of attachment or transport damage, etc., please contact us soon.

3.3 Installation environment requirement, method and matters need attention



Picture 3-2 Installation location drawing

Caution:Be careful of the sharpen edges of the packages and edges of the machine.

3.3.1 Ground requirements

1) The ground where install the equipment should be flat .The laser, bed and the working area height difference should not exceed 10 mm. The place where not flat must use the adjustment mat iron to leveling.

2) Lathe bed and table leg of the entire installation surface thickness of concrete is not less than 200 mm, crushing strength shall not be less than 30N/mm^2 , load is greater than 30 KN/m^2.

3) The entire installation surface of the fuselage must be consists of a smooth continuous slab within the scope of every supporting points .New floor/pressure plate must be avoided this case such as the weather is dry, the floor/pressure appears cracks beyond the following values. Do not allow the changes caused by machine's tilt make the travel range of laser beam on the lens more than 0.5 mm.

3.3.2 Environmental requirements

1) Environment temperature

When operating machine, environment temperature must be between + 10 ℃ and + 33 ℃. In machine shutdown, the ambient temperature of installation site shall not be reduced to + 4 ℃ below.

Caution: To avoid hot deformation because of the sun shining when installed near the window position, please fitted with shutters to avoid these situations. Please put the gas tank in the shade place .As the high pressure of the gas pressure gas tanks have explosive properties in higher temperature surroundings.

2) Outside air

In order to not affect emission quality, so much, must ensure that installation location hasn't been able to absorption wavelength of laser is 1.06 μm ray particles or material. Such as paint sends out a steam containing solvents, or steam from oil removal device.

3) Laser resistant device

When environment temperature is 35 ℃ to 43 ℃, equipment must assemble laser resistant device (such as air conditioning, etc.

4) Control system's cooling

Control system's cooling depends on the closed control system internal air circulation within the enclosure .Thus ensure the parts maximize not contaminated with dust and dirt .Wet room is not suitable for control system running, especially contactor and relay contact will corrosion, resulting in control system failure .The humidity environment must less than 70%

3.3.3 Vibration requirement

Due to a change in the load of the equipment surrounding area caused by the external function will affect the workpiece cutting quality. For example:

1) Forklift, land transport, etc.

2) Directly beside the equipment install or remove other machines.

3) Machines which will cause vibration in operation, such as punching machine, bending machine, shearing machine, etc.

3.3.4 The user of the measures should be taken

1. All work must be transported in accordance with the relevant rules
2. Do not allow the machine under no the ground floor, because otherwise the bottom of the components will be damaged! Machine tool with foot motherboard must be less than 100 mm above the floor. In the process of machine tool transportation to the site of installation must also guarantee the distance from the earth
3. The foundation installation site conditions must meet the requirements of the installation conditions. Installed in the hall on the floor for slitting, punching, etc. must be on their own by the user according to the foundation plan ready before the machine arrive
   a. From the truck with a lifting force corresponding truck crane to unload machine tools.
4. Laser, such as refrigeration device, suction device can use a fork lift truck directly from the truck transport to the machine installation location
5. On the armoured roller machine tools from outdoor handling in the workshop
6. With starting power is in the workshop bridge crane or continue on the armoured roller machine to the installation site
7. To take advantage of the armoured roller machine put to the place of installation and alignment position, need to use the hydraulic jack
8. Put machine in armoured roller, on the original installation location. If the position is not enough, you must inform me in advance the user service company. In this case can put machine tool according to the negotiation with suppliers on the installation of a placed next to the final installation site
9. Such as the installation smoothly, laser, refrigeration equipment and compact dust catcher are placed in the final installation site

- G.weike CNC after-sales service

1. Leveling machine: the G.weike leveling machine tool numerical control of the company's after-sales service and technical personnel.
2. Equipment in operation: by G.weike company service technicians will be put into operation equipment. Debugging work includes installation of equipment parts according to the drawing, connect the power of the equipment, to the teaching staff, and check for machine tool function.

3.3.5 Package

Cooling water machine for laser cutting machine, laser, operation box and accessories are packed in wooden cases, such as for the other parts are all in the outer packed in polyethylene foam and protective film packages,

protect it from external objects damaged parts of laser cutting machine.

3.3.6 Attention

- Machine transportation environment should avoid the rain, moisture, tilt, rat, potholes, such as damage, and ensure the well ventilated, transportation environment temperature in the range of - 10 ℃ ~ + 40 ℃, relative humidity is not more than 70%. Transportation and storage time not more than 24 hours, allowing the environment temperature does not exceed 70 ℃. Prohibited in open air for a long time. Because of all sorts of reasons to temporarily store, truly besides should comply with the above requirements, should also check their condition and packaging, to ensure that the machine from damage
- No climbing, standing or placed on the product packing weight
- Do not use the pull of cables are connected to the product or handling products
- It is forbidden to collision, scratched panels and displays
- Product packaging should avoid moisture, sun and rain
- Hoisting the machine tool should pay attention to drop spike light put, it is strictly prohibited to collision. When lifting rope can't touch the machine, if cannot avoid isolation must use soft objects.

Chapter 4 Installation and Connection of Laser Cutting Machine

Installation steps summarize

Connect the electric line→ connect the water cooling machine with the main machine body →connect the laser source with the machine body →connect the laser head with the machine body →Inset the laser cable into the laser head and lock the connection port →connect the laser source with the laser machine body →connect the gas line, water line with the laser head →connect the air filter with the machine body.

4.1 Electrical gas connections

a) Power requirements: 380V, 50HZ, laser electrical connections can be found in the laser specification.

b) Carefully reading the attached machine tool electrical schematic diagram; According to the laser cutting machine power wiring diagram wiring.

c) Check the total power and various power open action is sensitive.

d) Check the equipment power wiring is correct or not, as shown in the electrical wiring diagram.

e) Check the total power open or not and other power open or not (e.g., host, laser machine) must meet the capacity of drawing marked.

f) The wire diameter of power cord, ground wire and the zero line shall not be less than the power wire diameter on the wiring diagram.

g) Check ground wire of power cord is connected or not.

h) Check the entire high voltage wire terminal (especially the input and output point of power transformer) are reliable, strong, all of the plug and whether the board connection is reliable.

	**Caution:** The power cord's ground wire must be reliable grounding. Otherwise machine tool electrical signals within the tank will be disturbed and will be dangerous if leakage

4.2 The connection of the water cooling machine

-Pressure: minimum 1.5 KGF/cm^2, maximum 3 KGF/cm^2.

-In and out of the water pressure difference, at least more than 2 KGF/cm^2.

-Temperature control range: ： 20±2°---22±2°.

-Cooling water: Do not contain mineral water, distilled water or deionized water (Don't use mineral water);

-The valve and pipe: All are stainless steel or high pressure rubber hose, cannot use galvanized material, pipe joint use stainless steel clip.

-An external laser pipe: fiber laser special pipe (laser attached). If the pipe length of the water cooling machine is more than 10 meters, need to increase the pipe size, must make sure the pressure difference which laser need to. Various laser, each tube connection size also varies .Other cooling water pipe, Pay attention to pipe joint sealing.

a) Install conditions

The installation conditions of water chiller should be installed in the rain and snow proof and no corrosive gas, the ambient temperature in 2-38 ℃. Should be leave sufficient units in and out of the wind ventilation space during the installation process ,the top of the unit distance from other objects should more than 2.5 meters, and around the unit distance of other objects should more than1.5 meters to ensure smooth air flow, it is forbidden to install the unit in ventilation in a closed stuffiness room, must ensure that the hot air from the water chiller is not back flow to the surface which into wind of the unit's condenser.(Please refer Picture 3-1)

b) Machine check

First clean the clutter in the water tank, to ensure that the water tank clean without impurities inside; Then check the joint of pipe system whether loose or not.

c) Installation method

Picture 4-1

Picture 4-2

Picture4-3

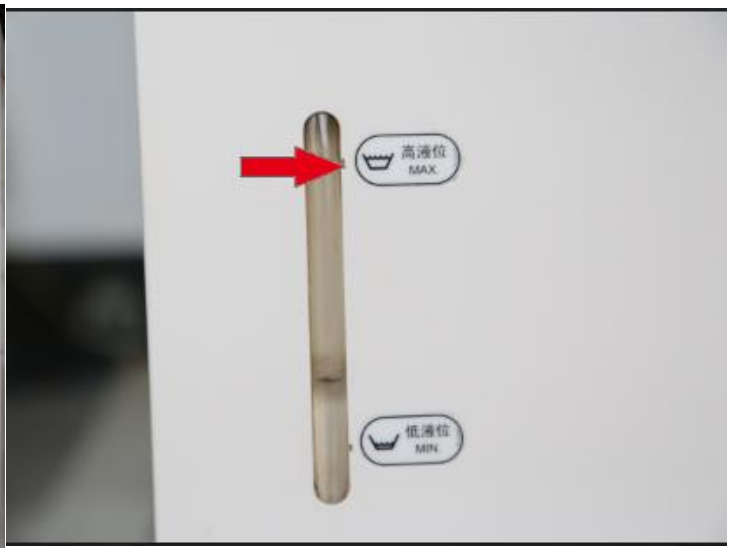
Please insert the A1 water line into A1 port,A2 water line into A2 port,A3 water line into A3 port,A4 water line into A4 port. Please tighten the nut of water protection

line according to the direction signed on the picture4-1

According to the sign of chiller shell connect the import and export pipe with laser imports (A1) and export (A2), and pay attention to the import and export direction, to avoid put connection wrong with import and export pipe. Before connecting pipe, ensure that pipeline without garbage and sundries, after connecting, there is no fold flat phenomenon at the corner.

d) Water quality standard

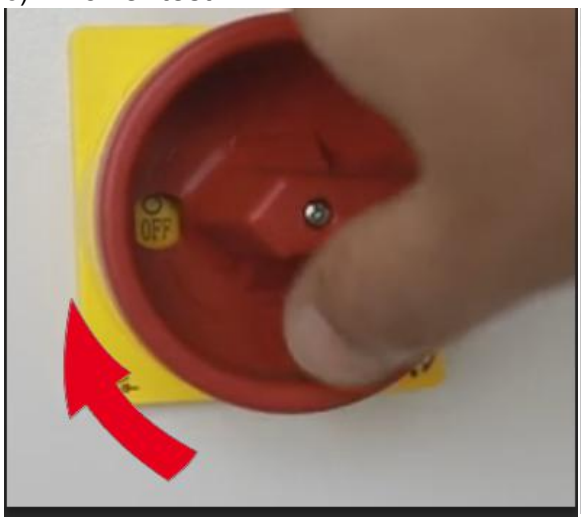
Picture 4-4



Picture 4-5

Open the inlet valve which marked on the picture 4-4 , add water to the tank. In the first time, the water better to reach the line which marked on the picture 4-5. Water level should be lower than the top edge of water tank 100 mm to 200 mm, in order to prevent water overflow from the tank. Water chiller are not allowed to use the tap water,but use pure water, distilled water or deionized water, Otherwise it will damage to water chiller's refrigeration machine and laser's radiator, damage machine components. Prohibit adding any corrosive liquid or not specified brand antifreeze into the water cooling machine.

e) Power test



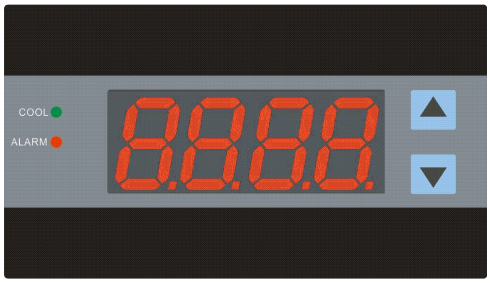
Picture4-6

Picture4-7

Open the water chiller (rotate the switch from picture4-6 to picture4-7) check

whether each indicator light is green or not. Use again after a long downtime, should power on unit above 2 hours in advance ,to make the oil heater which at bottom of the compressor start oil preheating automatically inside the compressor refrigeration (preheat state means: after electrify chiller control panel in the electricity outage state) and then can normal boot operation. Specific requirements please refer chiller the attached water cooling machine user guide.

f) Set the temperature



Key description

Name	Instruction
Up	To modify the setting parameter of major loop water temp or reflector path water temp under setting mode(the first 5 seconds is setting mode, nixie tube flickers, it is effective to press up arrow),. When the "Lxx.x" is displayed, the major loop water temp can be modified by pressing up, and when the "Hxx.x" is displayed, the reflector path water temp can be modified by pressing up. After setting parameters, delay 5 seconds, enter working mode.
Down	To switch the setting parameter "Lxx.x" or "Hxx.x" under setting mode(the first 5 seconds is setting mode, nixie tube flickers, it is effective to press down arrow), after setting parameters, delay 5 seconds, enter working mode.

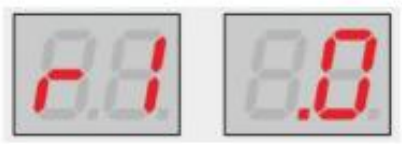
Display and indicator description

Name	Instruction
Refrigeration light	Working instruction of the refrigeration compressor
Alarm light	Shows that the equipment is fault, it should be repaired.
Major loop water temp	Used to display the circulating water temp of major loop. (Lxx.x) ℃
Reflector path water temp	Used to display the circulating water temp of reflector path. (Hxx.x) ℃
Major loop water flow	Used to display the circulating water temp of major loop. (LFxx) L/min
Reflector path water flow	Used to display the circulating water temp of reflector path. (HFx.x) L/min
Ambient temp	Used to display the ambient temp. (Axx.x) ℃

When the chiller working normally, the chiller displays major loop water temp (Lxx.x) by default.And by pressing "Up" or "Down" it cyclical displays Major loop water temp(Lxx.x) ℃, Reflector path water temp(Hxx.x) ℃, Major loop water flow(LFxx)L/min, Reflector path water flow(HFx.x) L/min, Ambient temp (Axx.x)℃. The water flow is for reference only.

Edition description

After power on, the chiller displays software edition first, for example, “r1. 0” means software edition is 1.0. Then enter setting status automatically. As shown below:



Parameter’s setting

Chiller set parameter recommend value(he user is subject to change as per practical condition）

Name	Value	Unit	Recommend
Major loop preset temp	Major loop set lower limit～Major loop set upper limit	℃	20-25
Reflector path preset temp	Reflector path set lower limit～Reflector path set upper limit	℃	30

After displaying the software edition, switch to 5 seconds’ setting mode automatically, the nixie tube displays the set value of major loop water, setting range is 15 ～ 27 ℃ (default value), increase the parameters by press up arrow(addend cyclical mode, that is continue to press up key when the temp set value up to 27℃, the set temp will go back to15℃); then press down key, the nixie tube displays the set value of Reflector path water, setting range is 20～40℃ (default value), increase the parameters by press up arrow(addend cyclical mode, that is continue to press up key when the temp set value up to 40℃, the set temp will go back to20℃).

Notice: 5 seconds’ setting status doesn’t mean to finish setting temp within 5 seconds. It means to modify the parameters of the controller in the first 5 second after starting-up, after that the parameters could not be modified. If not, the machine defaults no need to modify the parameters.

g) Try to operate after water cooling machine open

To ensure the in and off the water valve of water chiller is already connected to the user equipment and in a fully open position before starting the machine, such as chiller has inner loop bypass, should open the bypass valve.

Make sure the direction of water pump and fan are correct. Confirm the indicating instrument is normal, check the pipeline sealing, and according to the requirements of the laser required flow and pressure regulating valve for loop water pressure. If the cooling water in the tank is not enough, should be added in time. Please set temperature of cooling water according to the requirements of laser on cooling water temperature,

Attentions:

1) When water temperature reach the temperature controlled, water chiller will start constant temperature control automatic, and water pump within the unit works as usual.

2) Before open machine in the first time, must open the drain valve of the pump gas to valve the air, otherwise easy to damage the pump, at the same time, to adjust well the opening of the valve in the water system. Try not to adjust the water system's valve afterwards.

3) After water temperature of cooling and water in-out's pressure difference are to the required value, then open the laser.

4) When the room temperature is below the freezing point, such as equipment for a long time does not work should open water-cooled machine drain valve will drain the water cooling machine and water pipelines, in order to avoid cooling water ice damage to the equipment.

5) Daily work should always observe the cooler water level. When the water level is too low should be timely water and waterway inspection whether water leakage, such as leakage of timely repair.

6) When the filter is dirty, timely replacement.(Please refer)

7)Will the water cooling machine inlet and outlet pipes and power lines, signal lines put online box, prevent a stampede, causing water cooler job doesn't work.

h) Storage:

Do not contain mineral water storage allows only for short periods of time avoid water quality be affected. The water must be in a clean plastic container transport (without precipitation, without peculiar smell).

	**Caution**:Please avoid any unnecessary contact with the water (for example by hand).

i) Use:

All water injection of auxiliary equipment such as pump, hose, etc., shall be used only for the system with water.Before filling should be simple check, for the water not contain mineral water do color, turbidity and smell.

j) Color/opacity:

Smell any opacity (for example suspension, filiform, flocculent, particles, etc.) are shown out of the water is polluted. At this time are not allowed into the water!

k) Bouquet:

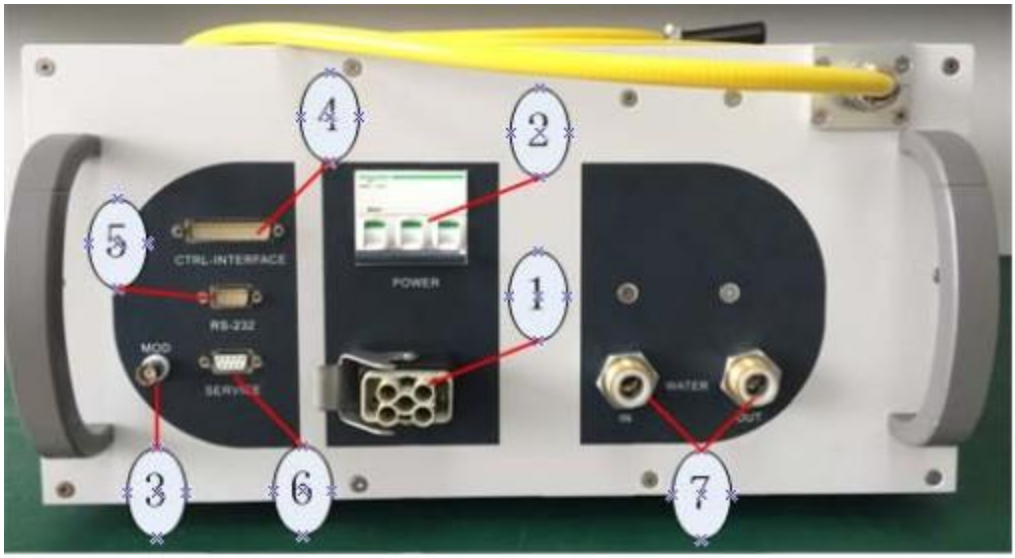
Any peculiar smell that smell is different from the normal shows ecosystem pollution in the first place. At this time are not allowed into the water!

4.3 Debugging install of Fiber laser machine

1.AC INPUT: The socket for supply input that can be only mated with the plug on the power cord we provided.（”1” on the Picture 4-8)

2. POWER: Air switch.（”2” on the Picture 4-8)

3.MOD: Modulation input, the BNC connector for switching the laser on and off in remote control modes. The control signal should be able to apply current over 20mA, and the voltage should be 24V. （”3” on the Picture 4-8)



Picture 4-8

4. CTRL-INTERFACE: Control interface, this interface is a male DB25 connector and it’s multi-functional. You can set the control mode and input analog control signal with the interface, and fault signal is sent from it.（”4” on the Picture 4-8)

5.RS-232: RS-232 serial port, this interface is a male DB9 connector, and will be used in hyper terminal and RS-232 mode. （”5” on the Picture 4-8)

6. SERVICE: This Service is a female DB9 connector, the definitions of the port is.（”6” on the Picture 4-8)

7. WATER: Pipe connectors, the inlet and outlet for cooling water flow in and return, suitable for 12 mm PU pipes. Connect the “IN” with the line which connect with the “A1” port.Connect the “OUT” with the line which connect with the “A2” port.(shown on the (picture 4-1 and picture 4-8).

Power Connection

A power cord is provided in the package, as in picture 4-9.

Picture 4-9

One end of the power cord is a plug; insert it in to the socket 'AC INPUT' on the rear panel .Notice that the plug is wrong-side preventing. After insert it, lock it with the lever.
The other end of the power cord is stripped off. There are five wires labeled L1, L2, L3, N and PE, respectively. You should connect the wires to the AC power supply according to the labels:
L1~L3-Phase Line
N-Neutral Line
PE-Protective Earth

Modulation Input

Picture 4-10

The 24V modulation signal should be applied to connector as in (Picture 4-8)“3” We provide a cable for the connector, which shows in (Picture 4-10)

RS-232 Serial Port

Picture 4-10

Please insert the wire on the (Picture 4-10) nto rs-232 serial port.
More details please check the attached Fiber Laser User Guide Manual.Please kindly read every details of the manual before operate the machine

The machine for fiber laser light path no need to debug, but it must be strictly to put optical fiber placement within the axis drag chain operation, and must ensure that bending radius is larger than 200 mm. Ban movement radius is less than 200 mm, fixed radius is less than 100 mm.

Take fiber from pan fiber spin out slowly, drag along the fiber imported machine tool and the shaft. Ensure the water pipe and air pipe is normal no leakage!

Before QBH inserted must ensure QBH head clean, clean according to the following method: using a special microscope observation components QBH head, using a dedicated compressed air or professional cleaner (ethylene propylene glycol) as well as cleaning tools fiber cotton swabs, lens

cleaning paper clean head of QBH dust and other dirt! Must ensure that the QBH head clean pollution-free, then can insert cutting head in the expanded beam!

Adjust the cutting head of coaxial and focus of the lens, then try to cut!

	**Caution:Install fiber must demand trained professionals to install fiber, it is forbidden to non-specialists plug QBH!**

Lens using considerations

	Focusing mirror, protection glasses, QBH head optical surface, do not use hand touch directly, causing the mirror so easily scratch or corrosion. If there is grease or dust on the mirror, will seriously affect the use of the lens, should be timely to clean the lens.

1. Optical surface strictly prohibited water, detergent and other cleaning. Lens surface coated a layer of special membrane, if use these to clean the lens will damage the surface of the lens.

2. Do not place the lens in damp places, this will make the lens surface aging.

3. The lens surface must be clean, if stained with dust, dirt, or water vapor, easy absorption laser lens coating damage; Light affects the quality of the laser beam, or a laser beam does not travel through or reflected.

4. When installation or replacement mirror or focus lens, do not use too much pressure, otherwise it will cause deformation of the lens, thus affect the quality of the beam.

4.4 Fiber Special Cutting Head

The cutting head is composed of the following parts. Please refer Picture4-11

Note: In view of the cutting head may be modified, with its own independent specification shall prevail, this manual is only for reference.

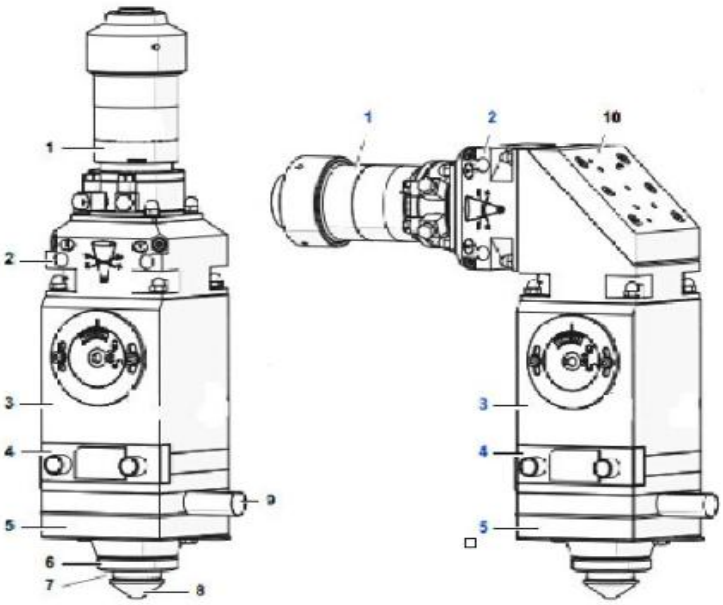
4.4.1Fixing of cutting head

Installation: set the laser head onto the machine, there are 4 M6x1(depth 14mm) screws on the back of laser head to fix on the machine. You can precise locate the position of laser head by the two pin holes on the back, and so the installation position can be copied. (Please refer Picture 4-12)

4.4.2 Height controller connection

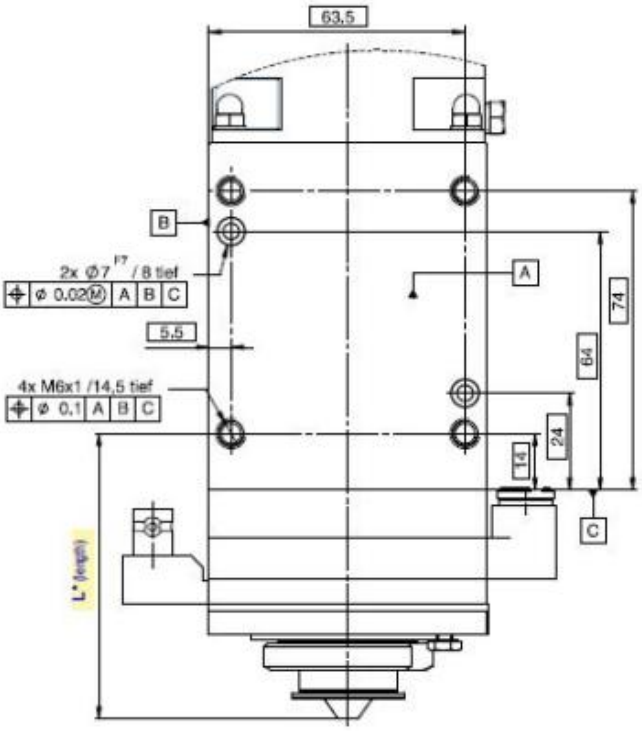
1. Plug the wire into the joint.(Picture4-13)

2. Tighten the blots and nuts.(Picture4-14)

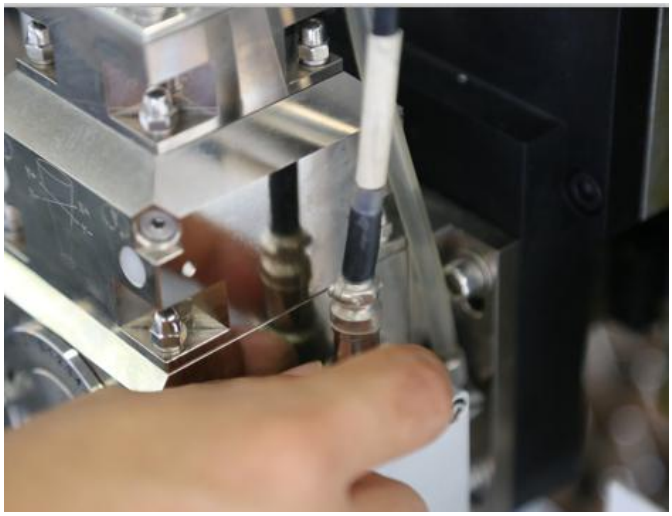


1 fiber laser head plug (QBH)
2 collimator component
3 focal adjustment component
4 protective lens component
5 sensor connector
6 connecting part
7 ceramic part
8 nozzle
9 signal connecting
10 optical module

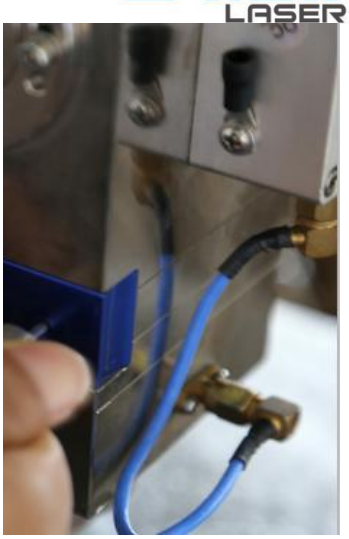
Picture 4-11



Picture 4-1

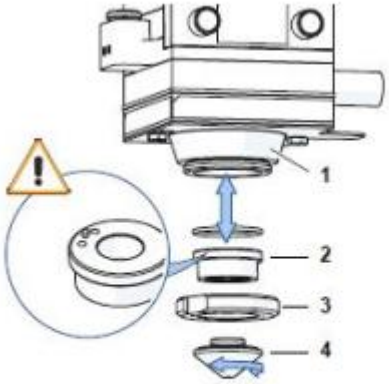


Picture 4-13



Picture 4-14

4.4.3 Installation of ceramic part & nozzles



Installation Picture

1. Sensor Part
2. Ceramic Part
3. Connecting Ring
4. Nozzle

Picture 4-15

1. Put the ceramic part into the sensor component carefully, the locating pins which on the sensor part should insert into the ceramic part.The nozzle should put into the connecting ring by hand to avoid some damage if you use any tools. In addition, make sure all the surface of these components is clean.
2. Tighten the connecting ring (Picture 4-15 “3”) with ceramic part (Picture 4-15 “2”) and set on the sensor part Picture 4-15 “1”).
3. Put the nozzle (Picture 4-15 “4”) into the ceramic part(Picture 4-15 “2”) by hand.

	**Caution**:Make sure the laser source is off or the red dot is on when install the nozzle.

4.4.4 Piping

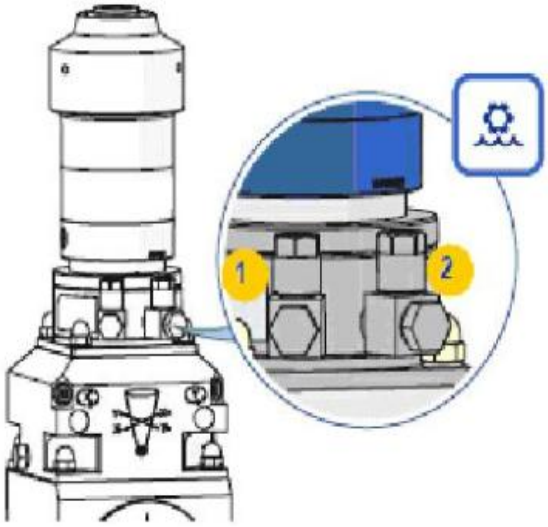
1. Water Cooling System

The water inlet and a water outlet pipe structure. Please refer picture 4-16.

Caution :Cold Water
Only pure water or distilled water are available, conductivity< 20 μ S/cm.
It must keep a certain temperature in water circulation access to avoid mist condensation on the lens.

Maximum water pressure to cooling nozzles is 0.5MPa, and makes sure the minimum flow rate no less than 2.0 l/min at the same time.
The outer and inter diameter of connector tube is ø6/ ø4 mm.

Collimator Component Water Cooling Connection
Picture 4-16:1. Water-in connector M5 2. Water-out Connector M5
Water connection tube: water-in tube for connecting 1, water-out tube for connecting.
（Connect the pipe which joint with B1 port to “1” →connect the “2” port with the “IN” port on the picture 4-16 →connect the “OUT” port on the picture 4-17 with the pipe which joint with B2 port on the picture 4-1.Clockwise to tighten connection fixing nuts block .For laser head and optical fiber head cooling of the inlet and outlet of the chiller and the inlet and outlet of arbitrary connected, no water flow direction, ensure the water outlet to form a loop can be.



Picture 4-16

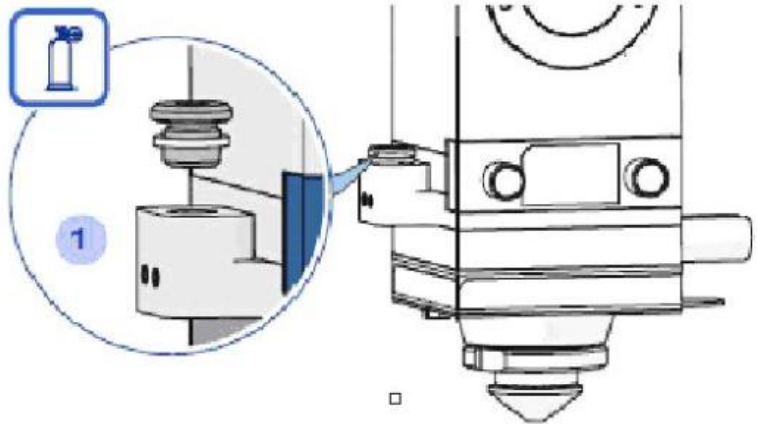
Picture 4-17

Caution: water cooling channel corrosion risk
To prevent any possible corrosion, the equipment manufacturer should set equipment maintenance cycle.
For protecting the water cooling channel (stainless steel material) from electric chemical corrosion, please use stainless steel or plastic material (no copper or brass)

2. Cutting Gas Connection

Pay attention – Gas-tightness

Please be sure that all the laser head connectors are locked and tightened by screw-plug before using, or the laser head will not work if there are gas or liquid entering into it.



Picture 4-18
Cutting gas G1/8 connector(depth 8mm)

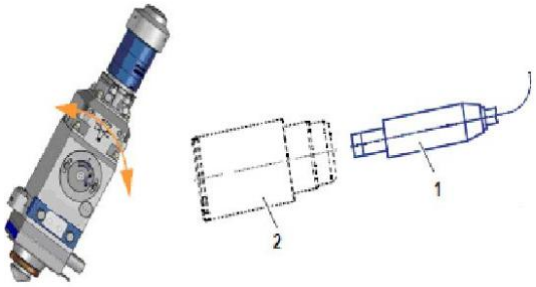
Caution: cutting gas
Only pure and dry cutting gas are useful.
Cutting gas meet the standard of ISO 8573-1:2010, Class 2.4.3 (particle, water, oil)
Maximum pressure on laser head is2.5MPa.

3. Optical fiber introduction

This series of cutting head is suitable for most industrial fiber, and the fiber is imported by the optical fiber connecting block.
Sequence of operation:
1. The connection block at the top of the plastic protective cover is taken off.
2. The QBH hole alignment connecting the hole in the block, insert the QBH line in the end.
3. Clockwise to tighten connection fixing nuts block, as shown in Picture 4-18.
4. On fixed nuts again along clockwise to tighten.

Laser Optical Access

Caution :Keep clean on the working platform.Do the assemble and change work in very clean working environment, dust or dirty things are not allowed in collimator part, it will lead to laser head damage.



Picture 4-19 Fiber Access (QBH Connector)
Picture 4-19:1. fiber plug 2 .QBH connector

Clean the air :set the air processing component for service mode.

Fiber laser : we suggest you clean the fiber part on the laser head to avid dust enter into fiber connector, and insert the fiber plug in horizontal state.

More details please refer the water cooling machine user manual.

1. Take off the protective film or protective lid on fiber connector.
2. Insert the fiber plug into the fiber connector.
3. Twist and lock the fiber plug on fiber connector.
4. Do not twist or lock too tight, or it will break the QBH connector and fiber plug.

Installation attention

1. Lens avoids direct contact with hands;
2. Positive and negative duty to clear lens;
3. Use special tool, dismantling the lens

4.5 The connection of the gas


1. Connect the gas pipe with the gas valve then connect the valve with the gas bottle.


2. Clockwise to tighten connection fixing nuts block.

Please plug the gas pipe into the ports which marked on the picture then clockwise to tighten connection fixing nuts block.Please choose the port according to the gas you use

Picture 4-20

The connection of the gas work

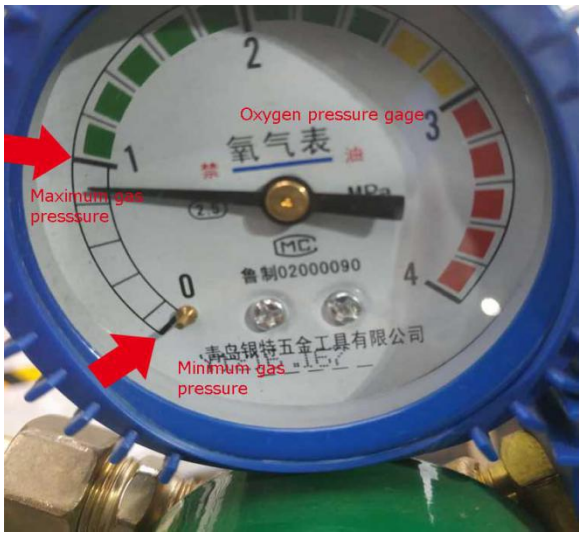
The machine equipped fiber laser,no need any dedicated laser gas!

b)The connection of auxiliary gas

1) Cutting gas requirements of purity

Laser Gas	Purity	Application Material	Pressure limit(BAR)
O_2	99.99%	Carbon steel	0<=P<=10
N_2	99.99%	Stainless steel	0<=P<=30
Compressed Air	99.99%	Carbon steel etc(materials which less requested)	0<=P<=30

(The user should by the pressure in local markets and check the pressure according to the gauge manual. The following picture4-21,4-22 is just for your reference The N_2 gauge is same with compressed air gauge)



Picture 4-21 Oxygen pressure gauge

Picture 4-22Nitrogen pressure gauge

1) Gas for cutting consumption

Cutting gas consumption related variables as below:

The diameter of nozzle

The cutting pressure

The laser cutting time

Cutting gas consumption estimates: the following is a list of cutting consumption when cutting in the standard pressure and high pressure , so as to estimate about the cutting gas consumption, use machine of the accumulation of data to estimate the determine material varieties and different material thickness.

Standard pressure cutting: It is to point to the nozzle exit pressure is less than 6 bar cutting. Need oxygen or nitrogen as cutting gas. Using O_2 for cutting under the condition of standard pressure, the available flowing pressure at joint of the machine tool at least ten bar(when the gas consumption is10 Nm^3/h, nozzle export Ø 1.7 mm, and cutting pressure of 6 bar) .

High cutting: Cutting refers to the high pressure nozzle pressure is greater than 6 bar cutting. In general use nitrogen as cutting gas, a small number of cases is also used by oxygen. high pressure cutting as a option to provide for processing of stainless steel and aluminum profile.

c） The input pipe for supply cutting gas Cutting gas connection position

Cutting gas input line by the user to the entrance of machine tool joint.

Gas supply pipe must be installed to Ann in the figure shows the connection

location. Piping arrangement must be at least 150 mm from the ground, the pipes which in the front of the connecting position must have at least 1 m area for free configuration, so that when change the filter the pipe can be bent down to come over.(Please refer Picture 3-1)

The installation of a complete set of gas transmission system, Such as the gas container or tank of gas supply to the machine,are accomplished by a pipe. The carburetor must be designed to able to comply with all of the connection machine tool to by the biggest consumption. So that laying pipeline from the carburetor to the machine tools must be as short as possible.when external gas transmission system design and installation, be aware avoid the machine connect the input line and the connection position ice up.A stop cock must be installed in each input pipeline which connect to a single machine. In order to make the input line can stop input by the stop cock (for example, in the case of serving),it could also exhaust for the jet valve which in the machine connection.

Note: gas temperature is not allowed exceed 50℃, it is useful when

Raised Pressure Device produce the needed gas pressure. .

Cylinders or a set of cylinders

Users should buy the cylinders and gas valve, at local markets.There are some suggestion for the using of cylinders only for your reference.

To the cylinder pressure reducer used in cylinders or cylinder group is the simplest way of cutting gas supply, but require a large amount of manual work according to consumption. A set of gas cylinder group contains 12 gas bottle = about120 Nm^3 gas.

Air will interrupt when replacement cylinder or cylinder group.

This supply way applies to N_2 high pressure cutting under the condition with some premises.

Change gas method and points for attention

Cutting gas should be chosen high quality gas that production from a formal company,supply by one single gas bomb. It is suitable for cutting carbon steel by O_2, and the combination of gas bomb or gas jar are suitable for the processing of for high pressure N_2 cutting processing of stainless steel or aluminum plate, etc. According to the processing conditions to choose liquid storage tanks is the most simple and economic method of gas supply.

Note:The installation of high pressure gas pipeline installation requires professional personnel, the first time installation should exhaust to ensure the pipe can be clean before you can connected to the machine.

Ready to N_2 or O_2 and compressed air or air for cutting

First check the label on cutting gas bottle, whether accord with the requirement of machine tool use gas. Such as the requirement of the purity of N_2 or O_2, and the requirement of pressure. The level of the gas can't below recommended level of gas. Secondly ,connnect gases to the machine in a right way, open the cylinder connecting valve step by step, check the gas path to ensure that the pneumatic sealing. Only the air in air compressor after the processing of qualified by the clean air water filters, filter, dryer, precision filter, and other equipment can be connected to machine tools.

Note

1.Don’t run out the cylinders completely. When return the cylinders, residual stress in the bottle must be higher than the air pressure at least one atmospheric pressure.

2.When the laser gas pressure is low, laser cutting machine operation terminal will give alarm. Please replace the gas in time.

4.6 Air filter Installation

Picture 4-23

Picture 4-23

Using the attached iron ring to fix the machine air outlet and exhaust pipe together, tighten the screw on the Picture 4-23 .Insert the exhaust pipe into the hole marked on the picture 4-23.

4.7Installation debugging methods and relevant specification

Machine debugging need professor to do, will be implemented

strictly in accordance with the relevant regulation, please understand machine performance before debugging and reading relevant random technical data. Correct debugging is the basis of guarantee machine normal work, please contact with our company if you're not sure, we will give you a satisfactory answer in the fastest time.

Note: This debug method includes the normal debug method when machine online on electric.

Chapter 5 Testing and operation of the machine

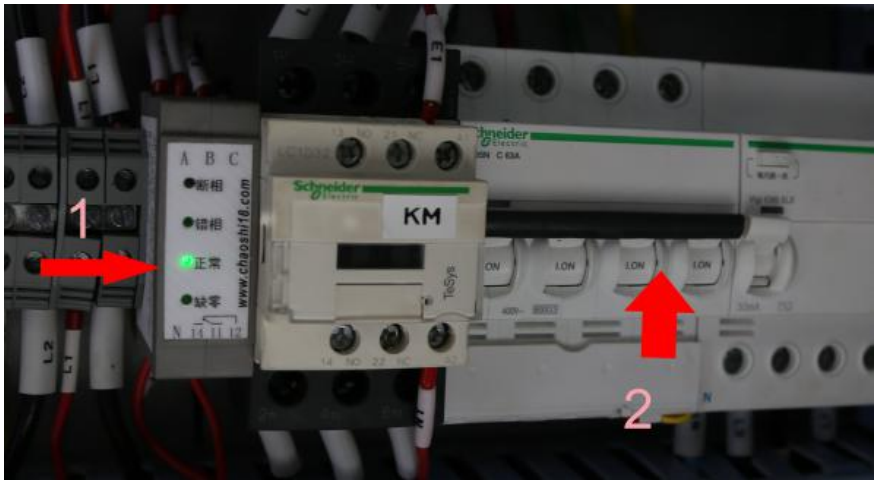
5.1Summarize and operation guide

Boot steps Turn on the power---Open water cooling machine---Open the emergency stop button---Turn on the laser source---Turn on the software---Back to the origin---Selective cutting gas---standardization---adjust the light---Drawing set cutting parameters---Go frame--- Cutting

1.Check equipment as a whole: before electricity mainly to check the machine's moving parts track route and workbench without exception.

2.An external device to start:

A). Start the total power supply: the total power switch, voltage equipment. When the light is in this position marked by No.1 arrowhead on Picture 5-1,turn on the total power switch according to the direction of No.2 on Picture 5-1 arrowhead



Picture 5-1

B) Cold water machine start: heck whether the state is normal, water supply is normal, waterways without slack phenomenon More details please refer chapter 4.2.Please check water after electricity, observe whether there is leakage phenomenon, and water pressure the direction of flown water-cooled machine by its "outlet" --filter -- fiber and cutting head -- water cooling machine "inlet.

C)Open the machine and computer host.

Picture 5-2

Picture 5-3

Picture 5-4 computer host

Clockwise the emergency stop button to open the machine then open the computer host

D).Open the laser source

Picture 5-5

Picture 5-6

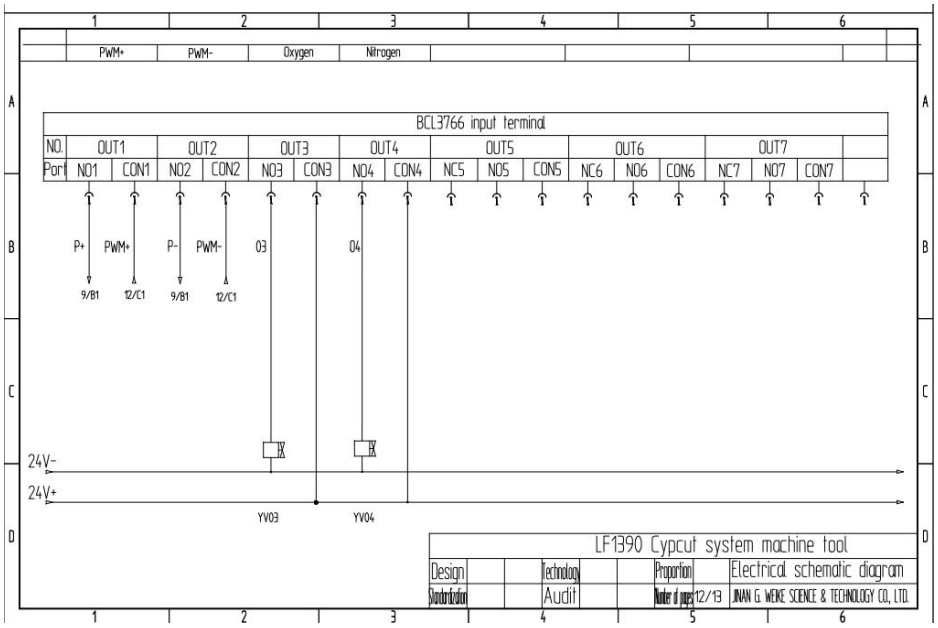
1.Insert the key into “1”(on the picture 5-5).The key should on the “OFF” position.→2. Turn on the main switch of the fiber laser source the “2” part on the picture 5-5)→ 3.Clockwise the “5”(on the picture 5-5) EMERGENCY STOP switch→4.Press the “LASER POWER” on the machine body .The Power Indicator will illumine (the “2” on the picture 5-5).

There are some difference between the laser machine user manual and laser source use manual in the boot steps .Please follow the manual.Any question ,please contact with our company .Please don’t change the operation steps randomly.

D).Assist gas supply equipment: open the air supply valve required, check the gas path of each filter equipment and pressure, The state of force table is normal.

Note: the water cooler may be modified, with its own independent specification shall prevail; this manual is only for reference.

5.2 RAYCUS Optical fiber signal line connection method

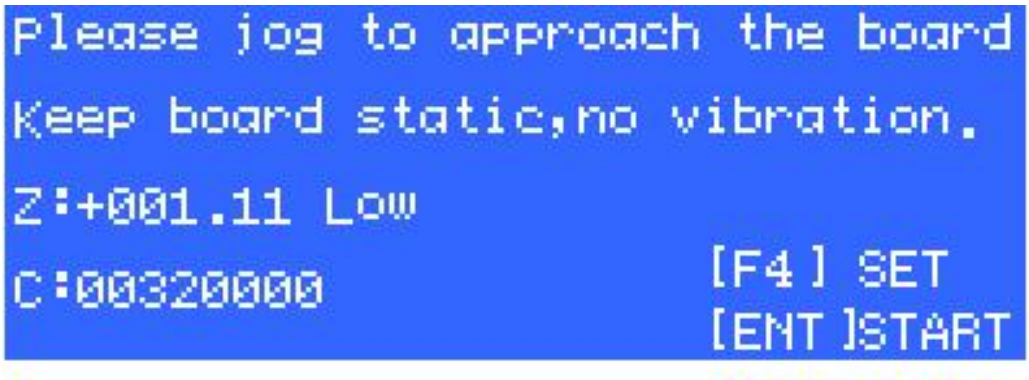


Please refer the LF1390 FIBER LASER CUTTING MACHINE ELECTRICAL DIAGRAM.

5.3 Adjusting laser head height and turn on the software

5.3.1 Standardization

Plates will be put to the cutting table, through the operation handle above the laser head to move to a board, [NC] button at the top of the click software, the pop-up dialog box, use the mouse to click on [F1] calibration - Calibration [2] floating, mouse the left key long press down arrow of the laser head moves to the plate 1 cm above the place, click OK, until after the calibration is complete (the degree of stability, smoothness in benign and above), click save, calibration is completed. As shown in Figure 4-19，4-20



Picture 5-7 Calibration initial interface

Picture 5-8 Calibration interface

Note:the height adjusting system may be modified, with its own independent specification shall prevail; this manual is only for reference.(More details please refer the height controller use manual).

5.3.2 Control software operation process

Making graphic data---data check---Making process parameters---Simulation processing---Processing output (More details please refer the attached use manual of the control software)

Turn on the software---leading-in---Find the corresponding format has been painted graphics. As shown in picture 5-9.

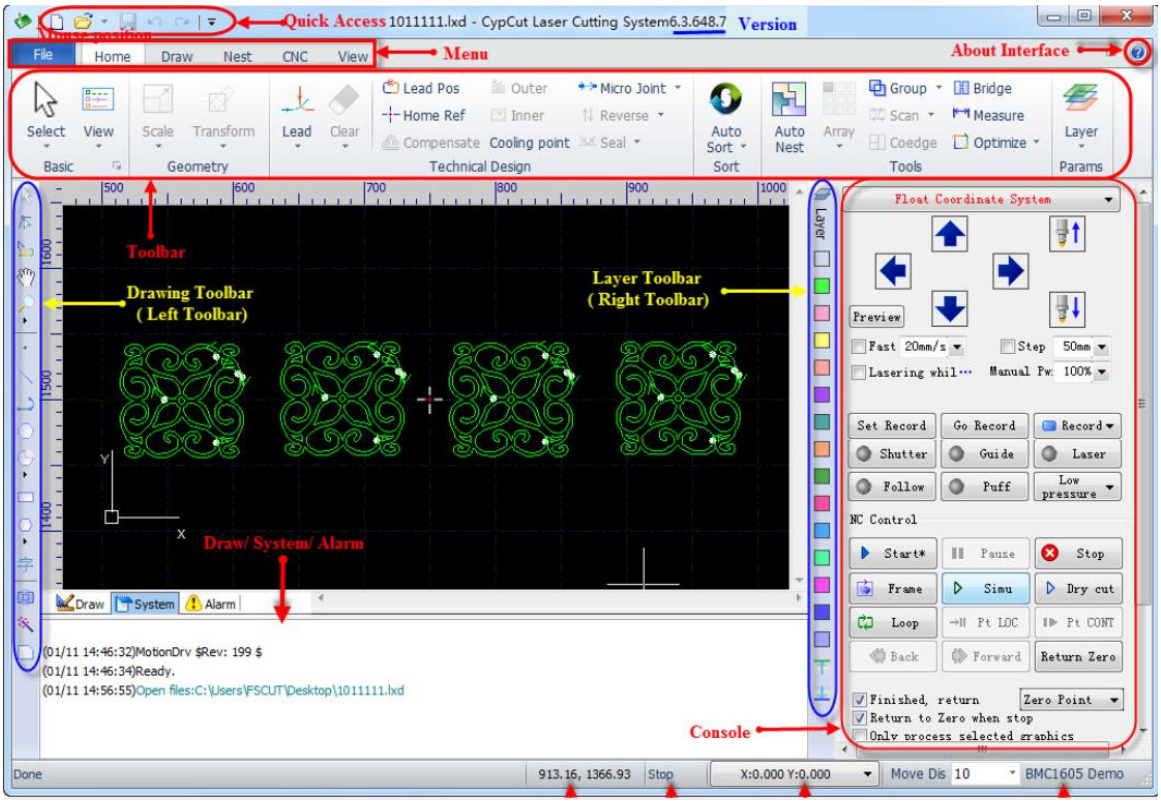
Set graph size, as shown in picture 5-10.

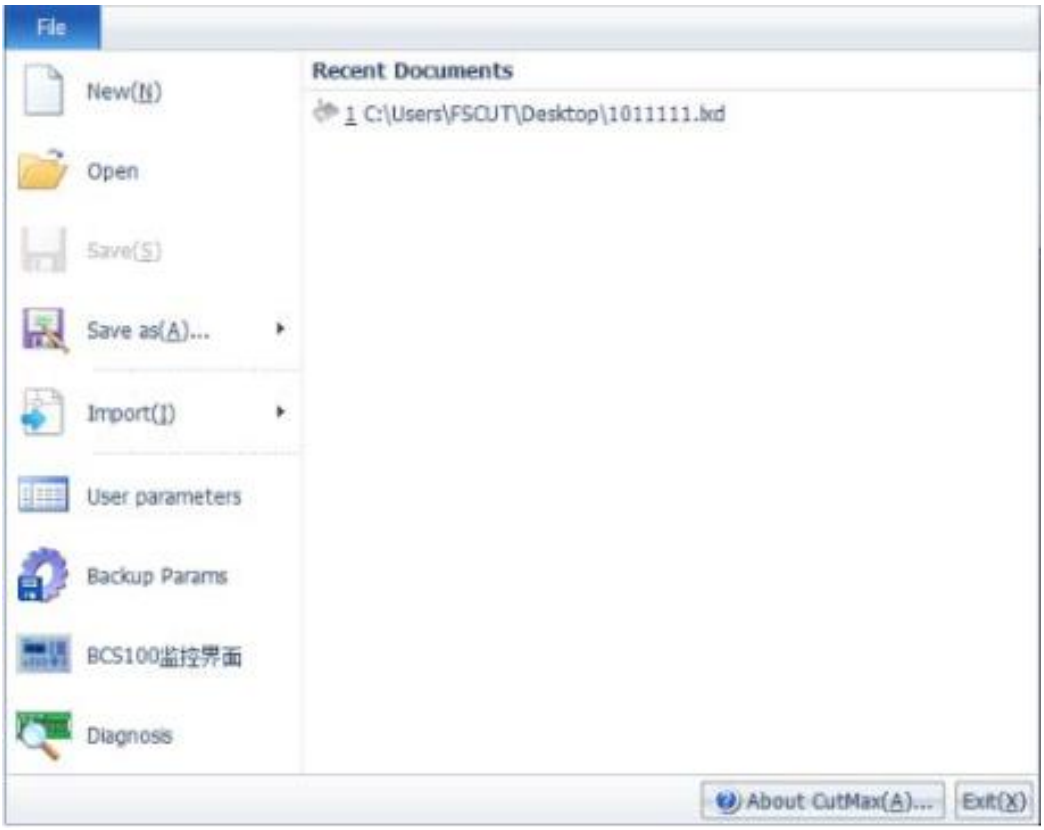
Set the lead outlet and lead inlet, as shown in Picture 5-11.

Sort; choose Small graphics priority as show in Picture 5-12.

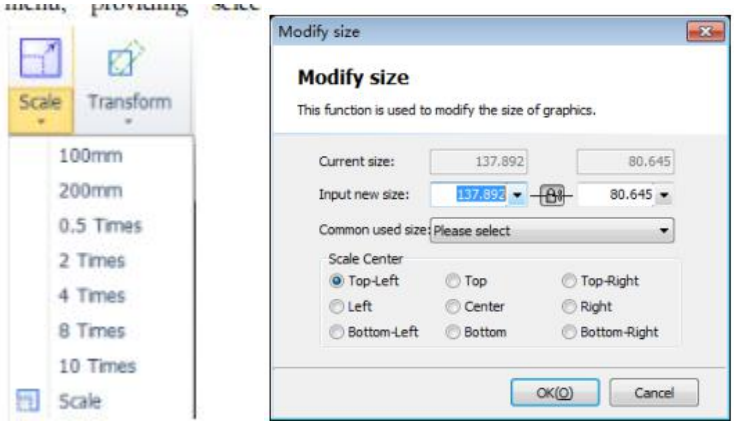
Simulation, as shown in Picture 5-13.

Adjust the cutting parameter .As show in Picture 5-14.





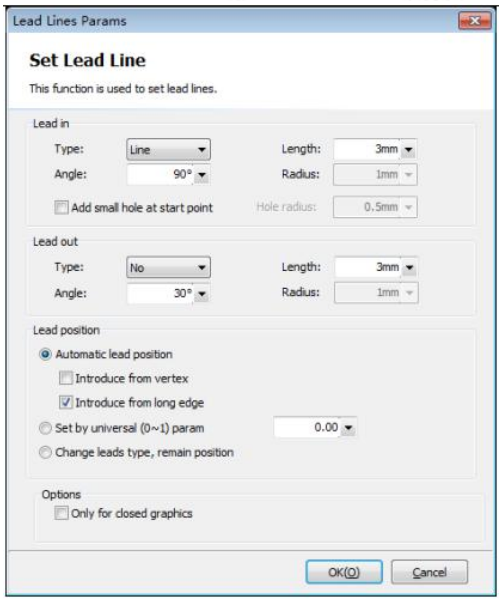
Picture 5-9



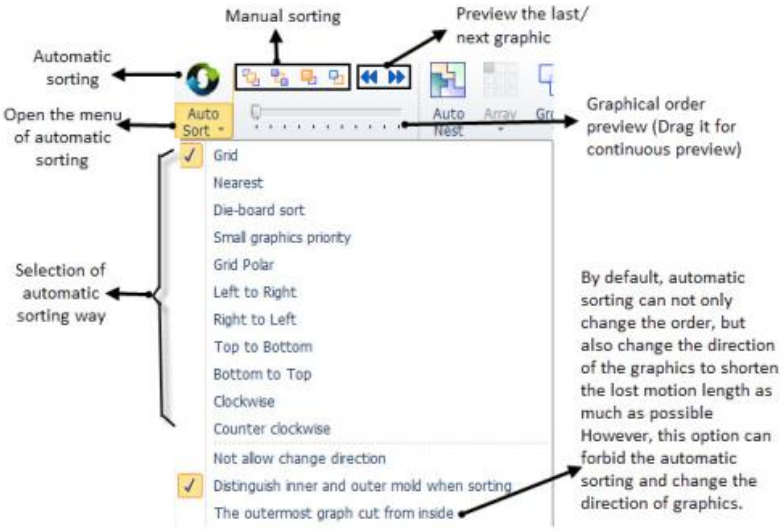
Picture 5-10

Please select the graphics to be set with lead lines, click the icon " 

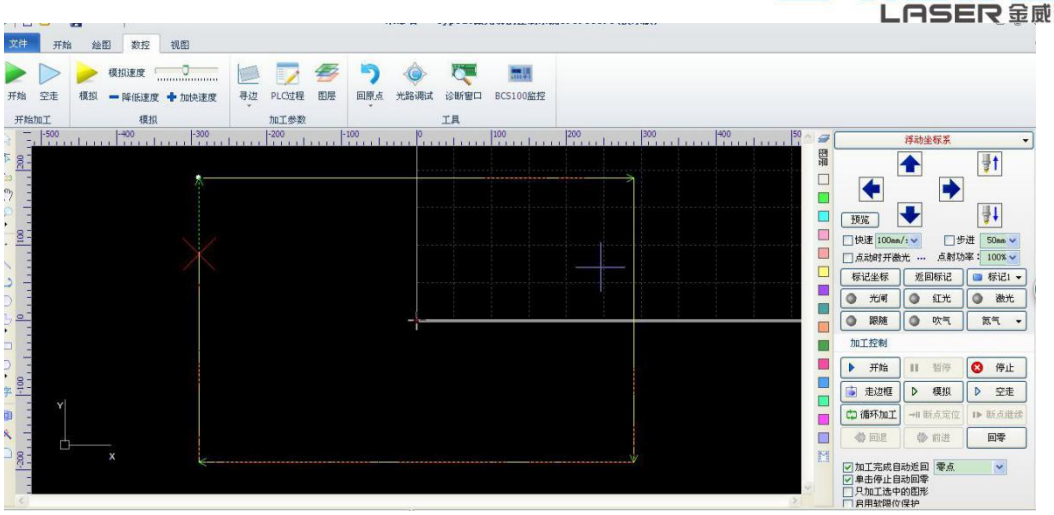
" under "Home" menu, then set the lead lines parameters in the popped window. As shown below:



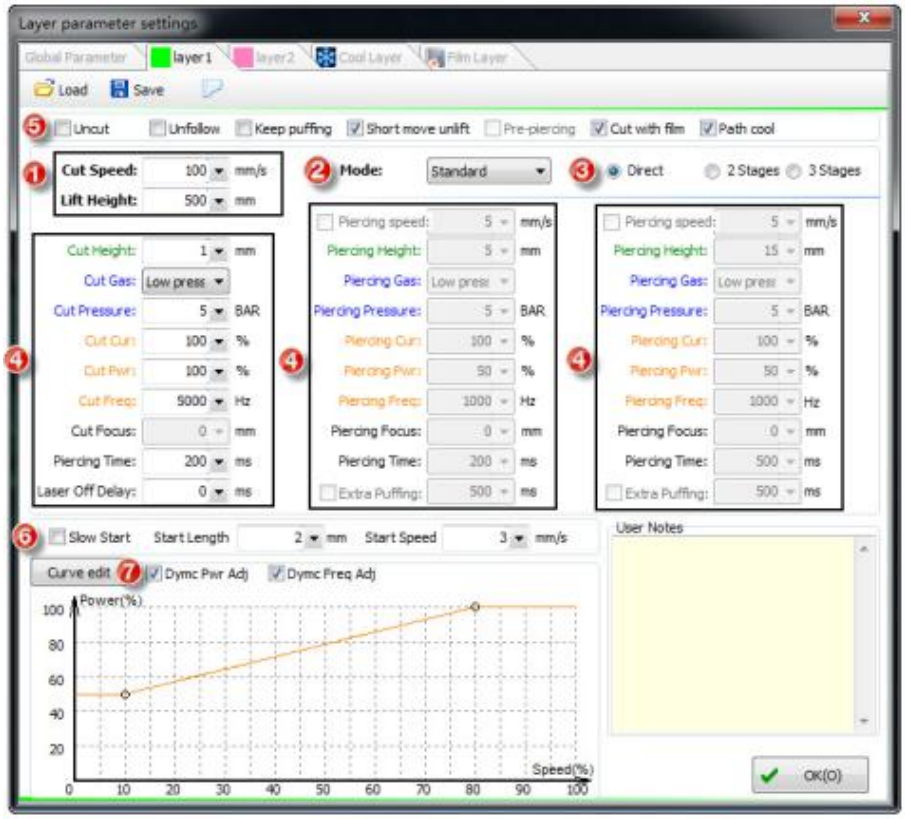
Picture 5-11



Picture 5-12



Picture 5-13



Picture 5-14

Adjust the focal length and cutting parameters

According to the plate and the thickness of the adjusting the cutting parameters (click on the software right "craft" icon, input parameters); regulation of laser and nozzle concentricity; adjust the focal length, click on the software interface of the lower right side of the "simulated" icon to observe cutting sequence is correct, all the correct go border cutting.

5.3.2.1 Take the border and cutting

Through the arrow keys on the handle will be laser head moves to the sheet cutting position, click the operating handle "walking frame, determine the processing location, click the handle on the" start "button to start processing, processing, when the hand is strictly prohibited to let go of the handle, so that an

emergency to stop operation of the equipment. After the completion of the processing reference" 4.2 machine shutdown procedures "

5.4 Regulating gas pressure

Open the pressure table: first loosen(turn left the knob)the pressure adjusting knob and then open the gas bottle,then adjust the valve to insure the pressure is in the safety range(please refer(chapter4.5) the finally according to gas pressure button on the operation system to adjust outlet pressure.

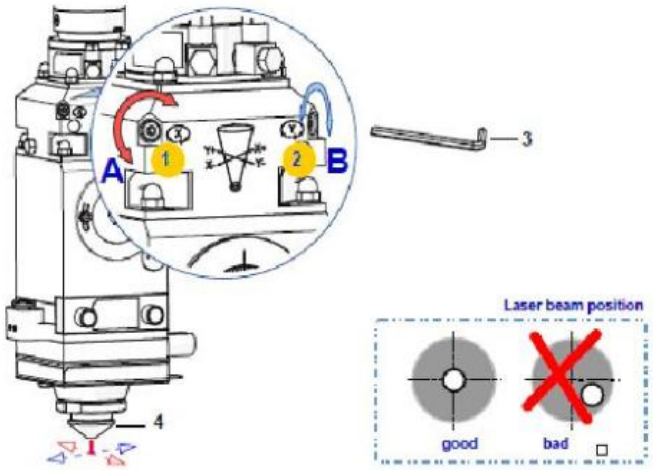
5.5 Adjust nozzle light

Laser Position Adjustment

When adjust the focus position, the system can not be pressured(no cutting pressure) and shut down the distance sensor system.

Caution: Laser Adjustment Error

Be very carefully to adjust the laser position, it may result in damage in laser cutting procedure if improper adjustment.



Laser Position Adjustment

1. adjusting nut, A
2. adjusting nut, B
3. Hexagon wrench（2mm）
4. nozzle

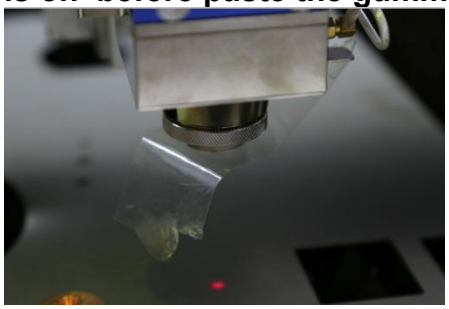
Picture 5-15

Use two adjusting nut(“1”,”2” on picture5-15) to adjust the beam position
Adjusting range: ±1,5 mm Tool: Hexagon wrench(2.5mm)

If the device manufacturer has no other proposal, you can adjust like follow procedure:

1. Choose a wide opening nozzle, its opening diameter should be larger than the beam diameter, if the nozzle' s opening size is too small, then remove it.
2. Paste gummed paper on the nozzle opening.

Caution: press the "shutter" button make sure the red dot like picture 5-16 is on before paste the gummed paper on the nozzle.

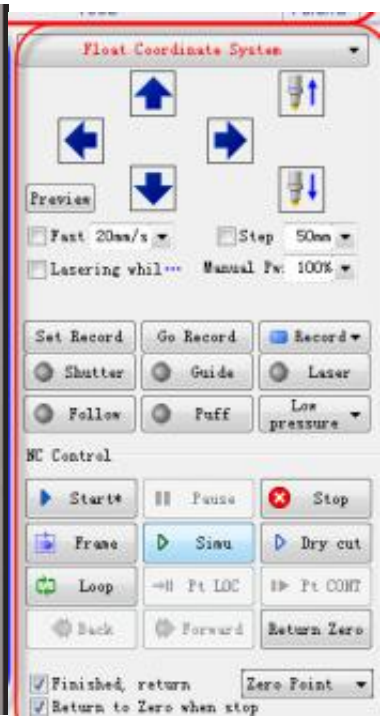


Picture 5-16

Caution: Please wear laser protective glasses. It may cause level 4 laser in actual use and may hurt your eyes.Do not look directly on the laser in any case, even if you wear some protective devices.Use standard protective glasses.

3. You can use the handle or click the button on the operation system Press the "SHUTTER" button to turn off the red dot →Press "LASER" button to release the laser beam.→ Press the "SHUTTER" button to turn on the red dot. To penetrate gummed paper on the nozzle and check the paper whether the hole is round or in the center, if not, adjusts the lens.

Picture 5-17



Picture 5-18

4. Make the laser position aligned and centered by adjusting the two nuts(picture 5-6 "1","2") on the laser head.

Pay attention: the maximum adjusting range is ±1.5 mm.

5. Put a piece of gummed paper on the nozzle again, use low power laser to penetrate again and check the hole round and center position for 2-5 times until the laser beam is centering in the nozzle opening. Then change a small opening nozzle and do the ways again till laser beam is in the center of nozzle opening. The laser beam after adjusting must locate in the center of nozzle (will use now) opening.

Caution: Do not stop laser to avoid any damage.

5.6 Nozzle function and central adjustment

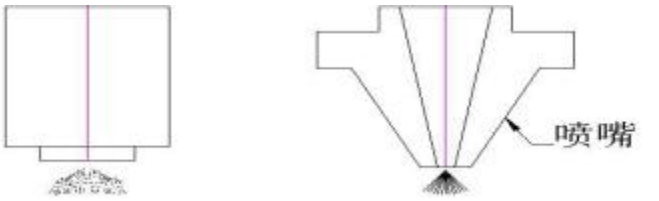
5.6.1Nozzle function and adjustment

5.6.1.1Nozzle function

The design of nozzle and jet flow, directly affect the cutting quality. The manufacturing precision of the nozzle, is closely related to the cutting quality. Nozzle's main functions are:

1)To prevent cutting fused stains damaged focus lens and rebound upwards into the cutting head of debris.

2)Nozzle can change the cutting gas, control the size area of the gas diffusion and, thus affect the cutting quality. Picture 5-19 is the install nozzle and not install nozzle, gas jet.



Without nozzle with nozzle

Picture 5-19

5.6.1.2 Laser and nozzle adjustment

Adjust nozzle make laser through from nozzle center, details ways as below:

a)Put nozzle move to cutting height

b)Scrible on the surface of nozzle, then put white no-dry adhesive tape on the surface.

Adjust laser input power 20w--150w. After laser out of light stop, put no-dry adhesive tape off, attention not move its relevant position. If distance between nozzle position and laser center has a big different, no-dry adhesive tape will not open center hole; due to laser central is fixed, then needs adjust bolt on the adjustment mirror cell handle to change the focus central, make it co-inside with laser central. Above action again, until laser on the white no-dry adhesive tape open the hole with nozzle central co-inside, then confirm co-inside laser central with nozzle center.

5.6.1.3 Nozzle's influence on the cutting quality and the selection of nozzle aperture nozzle

a) Connection of nozzle and cutting quality

Nozzle center is not concentric with the center of the laser, the effects of

cutting quality:

1) Affect the cutting section, when the cutting gas spewing, cause uneven gas, make the cutting section is prone to side has fused stains, on the other side of the phenomenon of no, or parts of all round quality is inconsistent, sometimes resulting in not normal cut.
2) Quality of impact Angle, the cutting Angle or the Angle of minor artifacts, prone to partial melting phenomenon, cutting plate, may not be able to cut.
3) When impact perforation, perforation is not stable, time is not easy to control, penetrates the cause of the thick plate is so fusion, and penetrates the condition is not easy to master, less influence on the perforated plate.

To sum up, the center of the nozzle and the concentricity of the laser is one of the important factors that cause cutting quality, especially when cutting the workpiece is thicker; its influence is even greater. So we must adjust the nozzle center and laser concentricity, in order to obtain better cutting section.

Note: Nozzle deformation or the nozzle melt stains, its influence on cutting quality such as described above, therefore, the nozzle should be carefully placed, may not be so as not to cause deformation that touch an injury; The nozzle with some melting stains should be clear in time. The quality of the nozzle is of high accuracy requirements in the manufacture, installation method is correct. If due to the poor quality of the nozzle to change the terms, cutting the nozzle should be timely replacement.

b) Selection of nozzle pore diameter

The pore diameter of nozzle	gas flow rate	The melt removal ability
Small	Fast	Strong
Big	Slow	Weak

Form 5-1

Nozzle diameter has φ1.5mm,φ2.0mm,φ2.5mm, φ3.0mm,etc.

Three-dimensional cutting sheet, commonly used φ1.2mm, φ1.5mm,The difference are:

1)Under 2mm plate use φ1.2mm, cut surface is fine; use φ1.5mm, cut surface coarser.

2) More than 2 mm thick plate: because of the high cutting power, cooling time is relatively long, relatively cutting time also increases. Use φ1.2mm.

Gas diffusion area is small, so is not so stable when used. With φ1.5mm, large gas diffusion area, gas flow velocity is slow, so the cutting is stable.

To sum up, the size of the nozzle aperture has serious effect on cutting quality, perforation quality, at present, a lot of 3d laser cutting use from φ1.2mm, φ1.5mm diameter of nozzle.

Nozzle aperture, the greater, relative protection for the lens is poor, because when cutting sparks of melt, play up the risk is very big, makes the life of the lens is shorter.

5.6.2 Adjusting laser beam focus

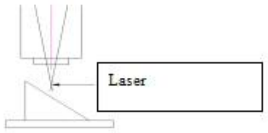
During laser cutting process, relative location between laser beam focus and cutting materials surface has big influence on cutting effect. It is very important to adjust the focus position. This kind laser cutting machine is equipped with automatic following adjusting device, when material height changes, control system could adjust automatically to make sure the distance between nozzle and material is constant, the focus position steady.

Manual adjustment method, adjust the adjusting nut at button of laser head, make the focus position meet the needs of cutting. On condition that, find the zero focus position. During cutting process, it is possible to adjust cutting height slightly according to adjusting operating board height to adjust rotary knob. It needs the very professional stuff to adjust the height during cutting process. It can adjust focus position automatically according to the setting parameter. Advantage of it is improving working efficiency, and it could make up the changes of focus position caused by changes of optical path.

5.6.2.1 Method to find focus position

Use triangular block to find focus (also could sue slant wood board instead)

A)Put one flat plate on working table, and put one fixed block with a hard board to form the three-legged structure. See picture 5-20.

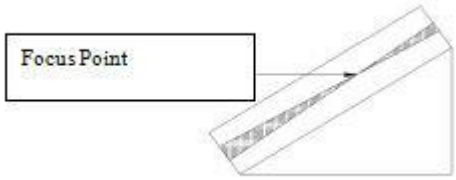


Picture 5-20: Adjusting laser focus 1

Adjust the focus automatically; it is equipped with auto adjusting laser head,

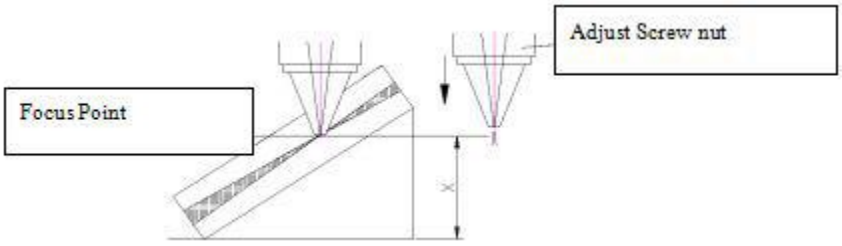
B) Take down the nozzle, adjusting nut to the lowest place of focus position, move Z axis and adjust Z axis height, fallen height can not intervene the triangular block.

C) Input execution find focus program, at this time not change Z axis height and move Y axis, the output laser will form burning-out trace on triangular block. The smallest burning-out is the focus of the laser. See picture 5-21:



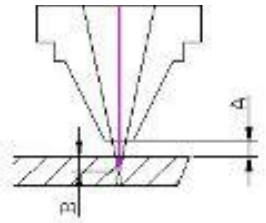
Picture 5-21: Adjusting laser focus 2

D) Install the nozzle, move Y axis to make cutting nozzle center to the above position of focus, Available to use red light as auxiliary. Manually adjust the focus adjusting nut to make cutting month close to the boar. The position that cutting head scale showed that is the zero focus position. Keep in mind of this. See picture 5-22:



Picture 5-22: Adjusting laser focus 3

E) Focus setting principle: distance between cutting month and material surface is A, it is called nozzle cutting height or punch height. Focus position definition: distance between focus to material above surface, see picture 5-23,B is the focus height. Focus position is above the surface called positive focus, focus position is below the surface called negative focus.



Picture 5-23: Adjusting laser focus 4

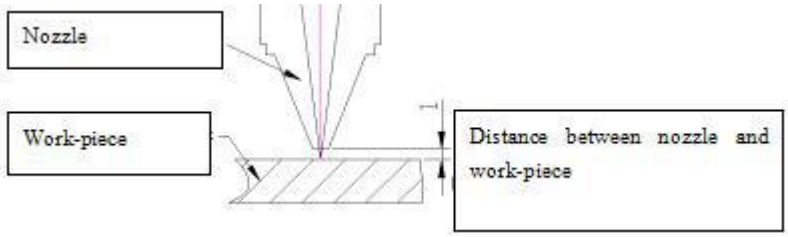
5.6.2.2 Relationship illustration of focus position and cutting material and cutting section

As shown in below form 5-2, when cutting different materials, the laser cutting focus is at different position, it has effect on plate punching and cutting section and focus position when cutting different material with different thickness.

Name and focus position	Cutting material and cutting section features
Zero position: laser focus position is on above material surface	Used for cutting thin metal Focus on the work piece above surface, above cutting edge is smooth, below cutting edge is not smooth
Positive focus: laser focus is on material surface	Used for cutting carbon steel and other material Focus on the work piece surface, so smooth surface scope is bigger. Kerf is big than that on zero focus. Gas flow is larger during cutting. Punching time is longer than that on zero focus.
Negative focus: laser focus is in material or on below material surface	Used for cutting stainless steel, aluminum and other material When cutting stainless steel, it needs HP Nitrogen to protect cutting section. Kerf is widened with the increase of the thickness of the work piece

Form 5-2 Relationship between focus and cutting material

5.6.3 Set distance between nozzle and work piece



Picture 5-24: Distance between nozzle and work piece

After adjusting sensor adjustment box, the follow-up distance between nozzle and work piece is adjusted by YRC Cutting head box of teaching. Please refer to instruction of cutting head.

5.7 Laser cutting process principle

Laser cutting is an advanced and widely applied cutting technology in material processing. It used high energy density of laser beam as “cutting tool” for hot cutting of the material. Adopting laser cutting technology could achieve all kinds of metal cutting, non-metal cutting and composite material cutting.

Widely used in every aspect.

5.7.1 Laser cutting principle

Laser cutting is the use of the focus’ high power, high density of laser beam artifacts, cause the place material rapidly melting, gratification, ablation, or reach the ignition point, at the same time with the aid of high-speed airflow and beam coaxial purify molten material, so as to realize start cutting, laser cutting is one of the hot cutting method.

5.7.1.1 Main mode of laser cutting

Laser fusion cutting and laser oxygen cutting

Laser fusion cutting

Laser fusion cutting is with laser heating melt metal materials, and then through the nozzle with beam coaxial injection of oxidizing gas (N_2, Ar, He, etc.) rely on the strong pressure of the gas to liquid metal, forming slot. Laser fusion cutting does not need to make the metal completely vaporized; the laser energy required is only about ten molecule vaporizing cutting, about10^7W/cm$^{2.}$

1).Laser beam to the surface, in addition to the reflection loss, the remaining energy is absorbed and heated evaporation materials into holes;

2).Once the holes forming, it as a black body to absorb all the beam energy, small hole is surrounded by a wall of molten metal, relying on the high speed air flow, melt wall remained relatively stable;

3).Melt isotherm artifacts rely on the secondary air injection pressure, made melt materials blow away;

4).With the work-piece or cutting head movement, small transverse and cut into a seam, continue along the seam at the forefront of laser beam irradiation, the melt material in continuous or pulse from the seam was blown off.

For sheet material, cutting speed too slow will make the most of the laser beam directly through incision throw energy, speed increase more beam material, increase the coupling power and material, to obtain wider parameter adjustment to ensure the quality of cutting area, to the thick plate material, due to the laser evaporation or melt products cannot move fast enough, beam on the material aspect in the slot many reflect, as long as melt producer before remove were cool air, cutting process will keep.

All laser cutting edges are striped, its reason is:

①. Cutting process started in the cause of oxygen combustion power value, and stop at lower power levels;

②.Cutting section is so steep that the power density on it cannot continue to maintain the melting process, and the cut surface forming steps, make the cut surface in the process of cutting intermittently forward;

③. Cutting reflect or absorb plasma or smoke can cause intermittent effect.

laser oxygen cutting principle is similar to the oxyacetylene cutting, it is to use laser as a heating source, with oxygen reactive gas as cutting gas. on the one hand ,out of gas and metal effect, oxidation reaction, release a large amount of heat oxidation; On the other hand the molten oxide and melt blown out from the reaction zone, form the incision in the metal. The brief analysis of as following:

1) Under laser irradiation, the surface of material is heated to the ignition temperature, then it acted with oxygen, acting Violent oxidation reaction, releasing quantity of heat. Under the influence of the heat, the inside of the material formed holes with steam. Around the holes is surrounded by the melting metal-wall.
2) The flowing of the steam makes the melting metal-wall move forward and the occur heat and mass transfer.
3) The rate of oxidation about oxygen and metal is controlled by Oxidation mass transferring into molten slag, and also the speed of the oxygen through molten slag to reach the ignition front.
4) The speed of flowing oxygen faster, the speed of the burning reaction and wiping off material higher. Meanwhile, also contributing the reaction product of the slit outlet -rapid cooling oxide.
5) Obviously, the two heat source of oxygen to help cut: laser energy and oxygen-metal exothermic reaction, a rough estimate, cutting carbon steel, oxidation reaction to provide energy for about 60% of all cutting energy, obviously, compared with an inert gas, auxiliary gas oxygen do high speed can be obtained.
6) Oxygen combustion rate is higher than the beam speed when the slot width and coarse: laser beam speed is greater than the oxygen combustion rate, narrow kerf width, smooth, faster, mutate to cut.
7) Because of oxidation reaction heat of large role, the purity of

oxygen and the quality of the plate have serious influence on the quality of the cutting. Laser oxygen cutting mainly uses in easy oxidation of metal materials such as carbon steel, as well as stainless steel, but the cutting section is black and coarse, and the cost is lower than inert gas cutting.

5.7.1.2 The feature of laser cutting

Laser cutting compared with other methods of thermal cutting, the general feature is faster speed and higher quality. Specific summarized as the following several aspects:

8) Good cutting quality

Because of the small laser spot, high energy density, fast cutting speed, the laser cutting can obtained the better gutting quality.

9) The slit of laser cutting is narrow, the surface of the slit parallel and has a perfect vertical degree, The size of the cutting parts reach high accuracy. Cutting surface is smooth and clan ,it even can be used as the last procedure, without mechanical processing, parts can be used directly.

10) After laser cutting, the width of the heat affected zone is small, the material performance around the kerf is hardly affected, and the work-piece deformation is small, high cutting accuracy.

11) Fast cutting speed, e.g. The cutting speed of 2500w laser cutting 1mm of thick cold rolled carbon steel plate can be up to 16-19m|min.

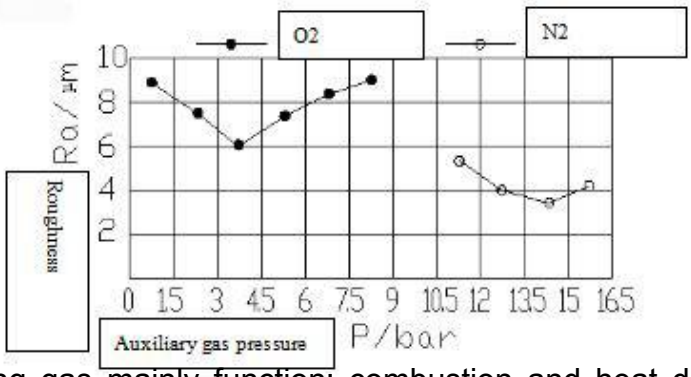
12) None-contact cutting , laser cutting nozzle and the work-piece out of contact, avoiding the tool wear.

The comparison of laser cutting, water cutting and plasma cutting are in the following table. The cutting material is 6mm mild steel carbon plate.

cutting method	Kerf width/mm	The width of heat affected zone/mm	The quality of section	Cutting speed	cost
Laser cutting	0.2—0.3	0.04—0.06	Vertical and clean	Very fast	high
Water cutting	0.7—1.0		Wedge is coarser	Very slow	low
Plasma cutting	3.0—4.0	0.5—1.0	Wedge is coarser	fast	Between low and high

5.7.2 The choice of laser cutting gas and pressure

According to the different cutting plate material, laser cutting select the different cutting gas. The choice of cutting gas and pressure has a great influence on cutting quality.



Cutting gas mainly function: combustion and heat dissipation, timely blow molten stains produced by cutting, and prevent the cutting of molten stains to rebound into the nozzle, protecting the focusing lens.

A) Influence of cutting gas and pressure on cutting quality

1) Cutting gas helps to heat and melt blown combustion, stains, so as to get better quality of the cutting section.

2) When the pressure of the cutting gas is insufficient, the cutting quality can be influenced by the following factors: the melt stain, the cutting speed. Could not meet the impact of production efficiency.

3) When the cutting gas pressure is too high, the impact on the quality of cutting: the cutting surface is rough, and the cutting seam is wide; at the same time, it can cause the cutting section to melt, which can not form a good cutting section.

B) Effect of pressure on the perforation of cutting gas

1) When the gas pressure is too low, the laser is not easy to cut through the cutting board, the drilling time increases, resulting in low productivity.

2) When the gas pressure is too high, causing the penetration point melting, forming a larger melting point, thereby affecting the quality of cutting.

3) When the laser is punched, the high gas pressure is generally adopted to the thin plate piece, and the punching method of the thick plate is adopted, which can eliminate the adverse factors of the low pressure to protect the lens.

4) Laser cutting machine in cutting ordinary carbon steel, the thickness of the material is thicker, the pressure of cutting gas is relatively lower, while in cutting stainless steel, cutting gas pressure is relatively speaking with the thickness of the material increased.

In a word, laser cutting when the cutting gas and the selection of pressure, must according to actual condition to adjust during cutting, in specific

applications need to choose different cutting parameters according to the specific situation.

5.7.3 The influence of laser cutting power in cutting quality

When laser cutting, laser power size selection on cutting quality also affected, cutting power can be determined according to the thickness of the plate material and plate cutting. Power is too large or too small is unable to get good cutting section

A) When laser power is too small, it will could not cut

B) When the laser power is too large, the whole cutting surface melting, too large, too large, can not get a good cutting quality.

C) When the laser power set is not enough, it will produce cutting and fusing, cutting the section to produce the tumor scar.

So set the appropriate laser power, with appropriate cutting gas and pressure, can get a good cutting quality, no melt stains produced

5.8 Note for use main machine, chiller, laser power supply.

5.8.1 Electric safety precautions

- Equipment with an electric voltage of 380V, to ensure that the power cord and short circuit switch to connect securely, so as not to cause damage to the power supply equipment.
- Equipment housing must be grounded to prevent damage to the device electrical components of static electricity, while preventing damage to the operator caused by leakage of the circuit when the operator.
- Maintenance and replacement of electrical components should be cut off the power supply, is strictly prohibited with the operation.
- Clear the circuit breaker, transformer, and the wiring board above the dust, so as to avoid the current breakdown of dust, resulting in damage to the equipment.
- After the completion of the work should be shut down the power supply, (off the laser power - water cooling machine power supply, fan power, air compressor power supply - machine power supply - total power supply).

5.8.2 Operational matters needing attention

1. Must strictly abide by the safety operation rules of the laser cutting machine.

- Open device power supply total brake
- Turn on the power supply of the water chiller, and the power switch of the air compressor and the cold dryer.
- Open the console power supply
- Open laser power supply

2. The operator must be trained to be familiar with the equipment structure, performance, and master the operating system.

3. Wear good labor protection supplies, in the vicinity of the laser beam must be worn in accordance with the provisions of the protective glasses

4. Do not have to know whether a material can be used for laser irradiation or heating, not to its processing, so as to avoid the potential dangers of smoke

and steam.

5. Operators are not allowed to leave the post without permission to bring the tube.

6. Fire extinguishers should be placed in readily accessible places; do not process to turn off the laser; not in the absence of a protective laser beam placed near the paper, cloth or other flammable materials.

7. Abnormal in the processing process, should immediately press the emergency stop button, timely troubleshooting or reported to the competent personnel.

8. Keep the laser, bed and ground clean, orderly, no oil, workpiece, sheet metal, waste piled up according to the provisions.

9. Use gas cylinders should be avoided when crushing wire so as to avoid leakage accident. Use of gas cylinders, transport should be monitoring procedures to comply with cylinders. Prohibit the cylinders in the sun prolonged sun exposure or near sources of heat. When the botle valve is open, the operator must be standing on the side of the bottle mouth.

10. Before open the power supply of water cooling machine, should check the water level of water cooling machine is strictly prohibited anhydrous or the water level is too low when open water machine, water cooling equipment to avoid damage. Around the water cooling machine on both sides and the top should allow sufficient space, prevent the fan blowing hot air into the inlet, water cooling machine. Cooler inlet and outlet pipe is strictly prohibited squeeze, stampede and keep the waterways.

11. Open the laser power supply must first before the water cooler, water cooler is stable to laser range can start the laser.

12. In the working process of the equipment, operation personnel should be hand operating handle (prohibited equipment work process, the handle is placed on one side) in order to in case of an emergency operator immediately press the pause or stop button. In order to operating device and causing unnecessary harm.

13. Prior to the start of processing, the work should be determined in the scope of the work piece of the plate in the plate. To prevent the start button in the press after the laser head to move to the plate outside the Z axis, the laser head hit the knife, causing damage to the head of the laser.

14. The product produced by the laser wavelength of 1064nm, radiation to the human body skin will cause burns, long time to look at the laser beam will cause serious damage to the eyes of the retina (such as cataract), the operator must wear 1064nm eye protection.

15. A large amount of smoke and dust will be generated when the equipment is cutting some plate, and the air outlet pipe of the fan should be induced to the outside, and the operator should wear a dust mask to prevent the occurrence of occupational diseases.

16. Laser cable is strictly prohibited to bend, so as to avoid the cable inside the glass fiber broken, cable exposed parts should be installed to protect the cover plate to prevent the step.

17. Air temperature at 0 degrees Celsius for a long time down, should be the water cooler, laser and water pipelines in the cooling water discharge, so as to avoid the temperature is too low to freeze water, causing damage to equipment and pipelines.
18. Finish the work should be close cylinders and gas curb stranded gas release, prolong the service life of the gas pipelines. At the same time, the X axis, Y axis moves to the machine to prevent screw for gravity deformation affects the cutting precision.
19. The equipment should be kept in a dry, well ventilated environment with no violent vibration of other industrial equipment.
20. Water cooling machine cooling water should use distilled water or pure water, fifteen days to replace the one time; protect the lens one day to clean, keep clean.
21. Laser cutting head should be cleaned every day, keep clean, prevent dust into the laser head, causing damage to the lens.
22. When something needs to be left in the operation of the equipment, the operating handle is turned off, and the operating table is hung with "without permission, no operation" warning board to prevent the equipment damage and personnel damage caused by misuse of others.
23. Regularly check the drive parts fastening screws are loose, regular cleaning guide, screw or rack oil
24. Equipment in the process of maintenance or repair interruption of power supply, is strictly prohibited to live repair or maintenance

5.8.3 Note on the use of temperature in spring and winter

- Equipment is located in the ambient temperature of less than 0 degrees, the water cooler to keep running state
- The boot environment temperature of water cooling machine shall not be less than 4 degrees, (factory setting temperature 4-25 degrees, the water temperature is less than 25 degrees automatic heating; water temperature is less than 4 degrees water cooling machine does not work, at this time can be heated with warm water or other heating methods).
- Laser temperature shall not be less than 0 degrees, the temperature of circulating water in 20 degrees -22 degrees, less than 20 degrees can not be used.

Note: **if the restricted conditions, the water cooling machine cannot be all-weather open, when the environment temperature is below 0 degrees, user should drain all the water in the water cooling machine or add heat preservation device on the surface of the water cooling machine. When the water cooling machine is off,please drain the water in the fiber laser source.Putting antifreeze into the water cooling machine is prohibited!**

5.9 After installation and debugging acceptance test program, method and judgment

Please refer technical sheets provided by our company the use manual of the machine parts and operation system.Any question please contact with our engineers,We would provide you the solution as soon as possible.

5.10 The machine shutdown procedure

1. After the completion of the processing, close the gas cylinder, the gas release, and the X axis and the Y axis to move to the middle of the machine, to prevent the transmission shaft due to its own gravity deformation, affecting the cutting accuracy.


Close the barometer: first turn off (turn right the knob)the pressure in the bottle, then release pressure regulating knob, press the handle “GAS” button on the handle (picture 5-17) or “PUFF” button on the picture 5-18 gas after the gas after removing the gas circuit pressure.

Press the Emergency stop button to stop the main machine body.

2. Turn off the laser source and laser power supply.

Press the laser power machine on the machine body.

3.Turn off the chiller power supply


Picture 5-25 Picture 5-26

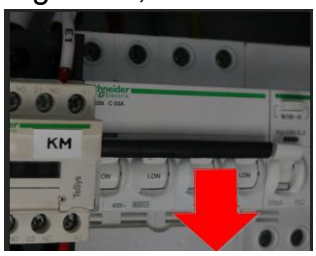
Turn the button from “ON” to “OFF” position as shown in the picture 5-25 to picture 5-26.

4. Turn off the air compressor valve and power supply

A. To manually drainage, discharge of oil, air compressor, will be at the bottom of the air compressor air tank drain valve open drainage, after the treated waste water discharge, close the drain valve.

B. Drain the air purifier by hand (not install automatic drainer), discharge of oil, will be the clean air, open the drain valve at the bottom for drainage after the treated waste water discharge, tighten the drain valve.

5. Off the dryer Turn, tools machine,computer host,supply power, power supply regulated, the external main and switch.



Picture 5-27

Picture 5-28

Turn off the main switch from the “ON” position to “OFF” position as shown in the picture 5-27 to picture 5-28.

6. Cutting head nozzle prevent, dust in the Seal air into the focusing lens.Paste a laser head on the head.

7. Machine surrounding environment condition check whether there is a fire or high temperatures object the fire prevention eliminates safety hidden trouble Patrol.

Chapter6 Maintain and trouble shooting

6.1 Summarize

In order to ensure the normal use of laser cutting machine, it must be for daily maintenance and maintenance equipment. Because of the whole machine adopts high precision parts, must be very careful in the process of daily maintenance, in strict accordance with the operating rules of each part, and shall be maintained, and shall not be barbaric operation, so as not to damage the components.

6.1.1 General rule

Use the most suitable lubricant for the quality of lubrication is to keep the machine tool. So that you can avoid the failures and its consequences. In this sense should pay attention to the following considerations.

- **Before operating:**Machine before put into operation, must be according to the lubrication lubrication machine seriously. If the machine for a long time have not used (such as ocean shipping), must check the lubrication condition of the whole machine.
- **Lubrication points for attention:**The lubrication of machine tools according to the lubrication chart and instructions of lubrication chart. It is recommended that you also pay attention to the following points:

1. Come on don't open in excess of the prescribed time and drains, and often kept clean.

2.Wash oil and lubrication points shall use only without fiber flock wiping cloth, do not use wool waste, do not use kerosene and gasoline, and to use the thin liquid spindle oil (" spray lubricating oil ").

3. Synthetic lubricants are not allowed to be mixed with mineral oil or other manufacturers of synthetic oil use. Even for other manufacturers of the same characteristics of synthetic oil.

4. Emissions of waste oil only in the warm-up state.

5. Must be special attention to the harmless disposal of waste oil.

- **Cleaning matters needing attention**: Must be within the prescribed time interval, the comprehensive cleaning the equipment. Clear dirt can scrub, or with industrial vacuum cleaners gettering.
- **Safety tips**: When maintenance work must be closed by a master switch to machine tools, to shut it down. Must strictly abide by the safety regulations, in order to avoid an accident.

The user should be regular maintenance spare parts as follows:

a. Acetone: purity of 99.5%, less than 0.3%, water capacity of 500 ml bottle.
b. Absorbent cotton: 5 packages.
c. Alcohol: 500 ml, more than 99.5% purity.
d. Lens paper: 5.
e. Air ball: 1.
f. Dropper needle: a (medical).
g. Organic glass: 200 * 300 * 20.
h. The ink stone (red) : 1.

i. Cotton swab: two packs.
j. Multimeter: 1.

Basic maintenance operation according to the following table:

6.2 The peripheral equipment daily maintenance and maintenance

About cold water machine, voltage stabilizer and laser and other peripheral equipment routine maintenance, please refer to the corresponding operating instructions, the following will only do general description.

6.2.1 Waterway maintenance

High-power role is largely laser cooling, cold water machine make laser under constant temperature condition, so good and regular maintenance is the key to guarantee the normal work of the machine;

Requirement of circulating water of cold water machine must use distilled water at the same time, but because of quality problems, there still exists certain minerals circulating water, dust and other impurities, and the dust in the environment may also be in some operating links into circulating water, these impurities deposition can lead to the water system and cutting machine parts (such as metal filter, cutting machine in the heat exchanger head) of congestion, which seriously affect the cutting effect and even burn out optical element. Environment of dust and debris on the radiator in the cold water machine, water pump accumulation will lead to the radiator and water pump cooling bad, resulting in adverse, burn compressor, refrigeration burning phenomenon of water pump, this also will directly influence the cutting effect; So cold water machine daily maintenance is particularly important; Various types of cold water machine daily maintenance must be strictly in accordance with their own cold water machine maintenance instructions (see chart 6-1,chart 6-2).

		**Caution**:Please wear dust mask,dust glasses and gloves when cleaning the air filter.The cleaner must be the professional person who have read the water cooling machine use manual before or familiar with the water cooling machine.

	The machine must stop before maintenance; maintenance shall be done 5minutes after the machine is powered off. Otherwise the risk of electric shock may occur. When the environment temperature is lower than 0℃ and the machine stops for long time, water inside the machine must be drained totally.

The mainten ance period	Maintenance content	Maintain the target
Everyday	1.Check the temperature setting is normal cold water machine(Set temperature 20±1℃)	To ensure the supply of the laser cooling water temperature is normal
	2 . Check whether the chiller water seal, water temperature, water pressure is achieved	Ensure the normal operation of equipment, to prevent leakage
	3. Cold water machine working environment keep dry, clean and ventilated	Running is good for cold water machine
Every month	1. Use will be cleaner or high quality soap to clear the dirt on the surface of cold water machine, please do not use benzene, acids, flour, steel brush, such as hot water to clean	Ensure that the cold water machine the surface clean
	2. Test whether condenser blocked by dirt, please use compressed air or brush to remove the dust in the condenser	Ensure the normal operation of the condenser
	3. Clean air filter： A. Open the unit panel of air filters, air filters will unit to pull them up and pull outward； B. Can use a vacuum cleaner, air spray gun and brush will filter dust removal, cleaning has been completed, if the screen pack damp, please reload after shaking to dry please refer picture 6-3. C. Dirt cleaning cycle: every two weeks, if serious, please don't clean on a regular basis.	To prevent cooling refrigeration poor, poor and burn out water pumps and compressors
	4. Check the water tank water quality situation and follow up	Good water quality, to ensure normal operation of the laser
	5 . Check whether there is cold water machine pipeline leakage phenomenon	Ensure that cold water machine without slack phenomenon

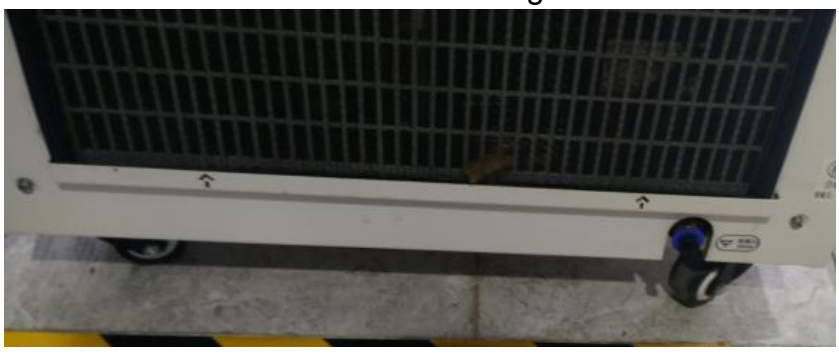
Chart6-1

Every 3 month	1 .Check the electric parts (such as switches, terminal blocks, etc.), with a clean dry cloth to wipe. **Caution**: Make sure the power is off when check the electric parts. Any problems, please contact with professional person to solve the problems.	To ensure the electric parts surface is clean, cold water to lengthen service life
	2.Replacement of circulating water (distilled water) and cleaning tank and metal filter; If with ROFIN laser, cooling water can be half a year after adding the corrosion inhibitor to replace a cooling water, if the PRC lasers, add the propylene glycol cooling water can be half a year after the replacement of cooling water at a time	To ensure normal operation of the laser
★★★ Matters needing attention： Long-term outage when required： A. Place the cold water machine and the pipe away from the dust. B. Will the power cord to pull away from the socket, will clean the power cord; C.Cleaning unit ontology: the units inside, please do not let the water splash on the electronic parts; D.The water completely ruled out.		

Chart 6-2

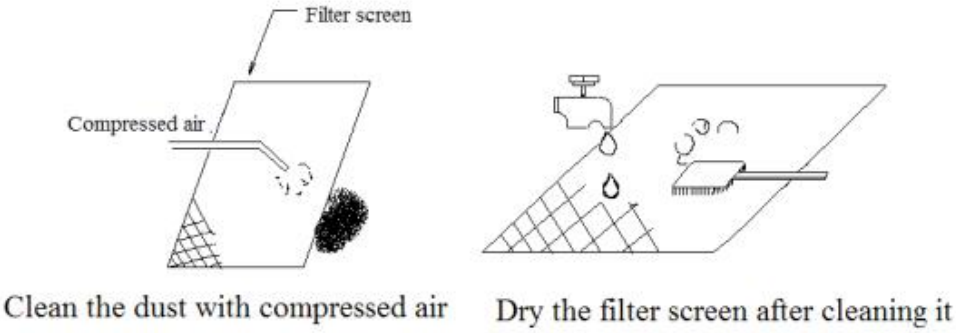
Picture 6-1

Clockwise the drain switch to discharge the waste water.



Picture 6-2

Dismantle the air filter as the direction shown on the machine see picture 6-2.



Picture 6-3

6.2.2 Laser Source and laser head Module maintenance

Fiber laser source can do basically **free maintenance**, the main daily observation of cooling water and cooling air conditioning is normal; The voltage is normal! If there is abnormal alarm immediately bond after-sales service!

	**Caution**: Don't dismantle or fix the laser source on your own, Please contact with our company when the laser source having problems.

6.3 Optical system inspection and cleaning

6.3.1 Something should pay attention

Optical lenses (protection lens and focus lens, etc.) on the surface, don't touch by hand directly, causing mirror surface scratch so easily. If there is grease or dust on the mirror, will seriously affect the use of the lens, we suggest check the lens every week and clean them in time.Please check and clean the lens according to the practical situation.

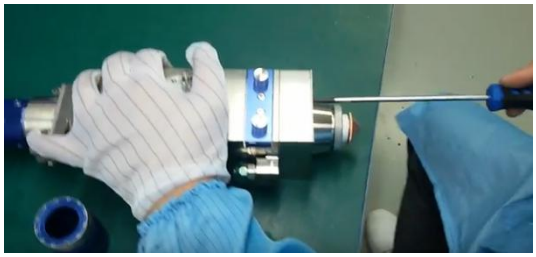
- The optical lenses are strictly forbidden to use water and detergent to clean. Lens surface coated a layer of special membrane, if use these to clean the lens will damage the surface of the lens.
- Do not use the lens placed in damp places, this will make the lens surface aging.
- The lens surface is stained with dust, dirt, or water vapor, easy absorption laser lens coating damage; Light affects the quality of the laser beam, or generating a laser beam.
- Lens injury occurs, should be repaired in a timely manner to the suppliers, and do not use the lens have been damaged as far as possible, otherwise will accelerate damage could repair the lens.
- In the installation or replacement mirror or focus lens, do not use too much pressure, otherwise it will cause deformation of the lens, thus affect the quality of the beam.

6.3.2 Dismantle ,installation or replacement the method of optical lenses

The dismantle process of laser head from the machine body are totally reverse with the install process.Please refer the installation process (chapter 4.4)

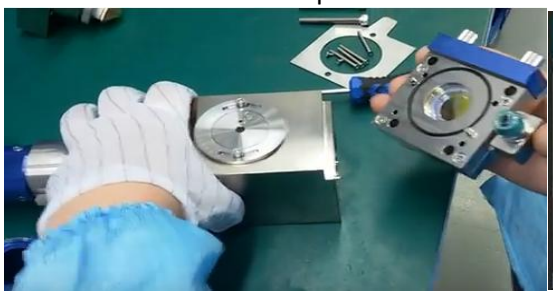
when dismantle the laser head from the machine body. And the dismantle of the laser head are totally reverse with the install process. So we just list the dismantle in this manual.

Dismantle of Focal Lens

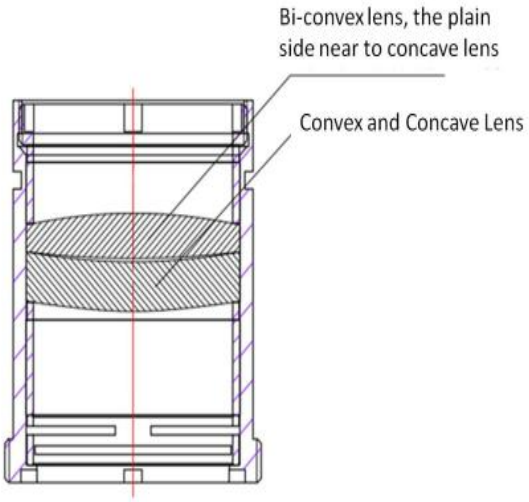



1.Turn left the instrument to loose the four nuts


2.Remove the dismantled parts then loose the other four nuts

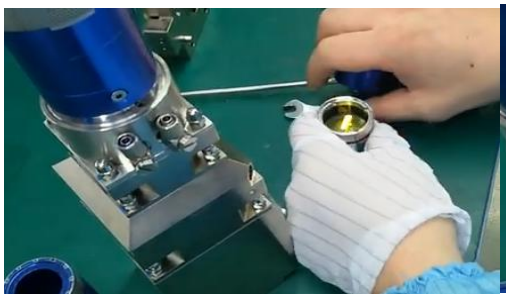
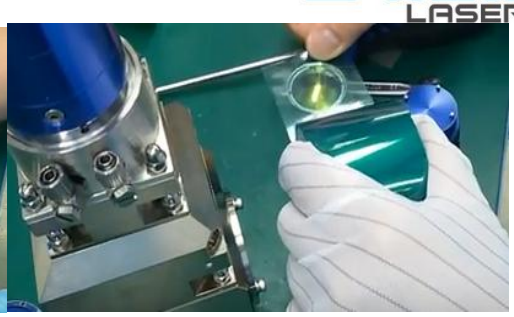



3.Put aside the protective lens(if don't need to clean), loosen 4 M3 flat head screws under the protective lens holder, take down the protective lens holder and then get down the focal lens barrel by professional wrenches



Picture 6-4

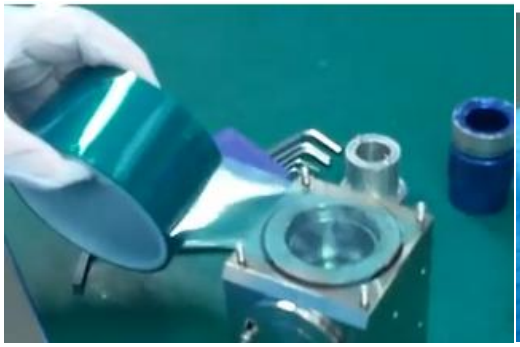
Caution:Please put the different kinds of lens in the right position as the picture 6-4.

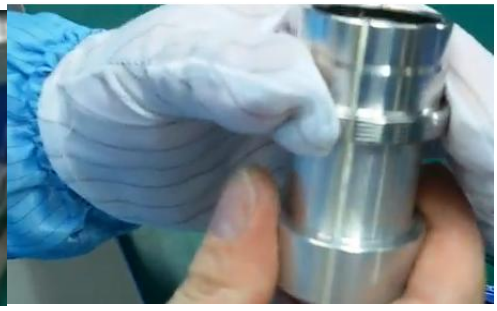
4.Use the wrapping paper to cover the lens,when clean another lens to avoid the pollution of the dust or water in the air.

Collimator Lens Installation

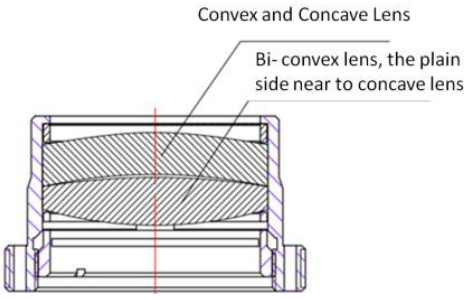

1.Clean the surface of laser head with anhydrous ethanol and then loose four nuts




2.Using the wrapping paper to cove the focal lens.

4.Take off the collimator lens with specialty wrenches

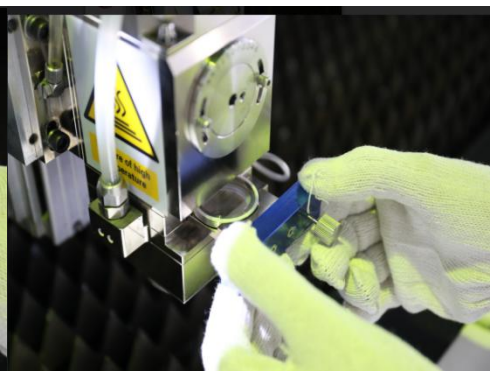


Picture 6-4

Caution: Please put the different kinds of lens in the right position as the picture 6-4.

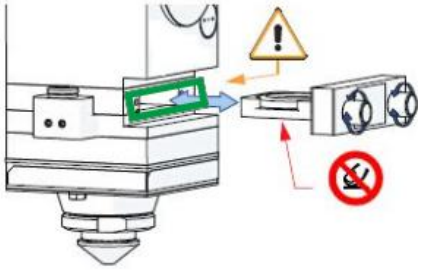
Protection lens dismantle

Picture 6-5

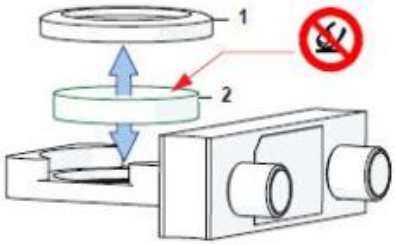


Picture 6-4

1.Turn left the switches on picture 6-5



Picture 6-6



Picture 6-7

2. Using the wrapping paper to seal the part marked by the green rectangle on the picture 6-6.

	**Note**: before installing optical lens wear clean, with soap or detergent to clean hands, and wear clean white thin gloves; It is strictly prohibited to any part of the hand contact lenses;Take glasses, should be put on the gloves, and from the side of the lens to take, do not touch the lens coating on the surface directly.

- When assembling the lens, do not use mouth blowing toward the lens; Smooth lens should be placed in clean the table, the following a few pieces of lens paper pad. Should try to be careful when you pick up the lens to prevent collision and fall, and on the surface of the lens coating, not exert any force; Install the lenses mirror should be clean, with a clean air spray gun cleaning lens seat in the dust and dirt, and then remove the lens, gently put her seat.
- When install the lens to the lens holder, fixed lens don't use too much power, in order to avoid the lens distortion, which affect the quality of the beam.
- Replacing the optical lens of note: be very careful when remove the lens from inside the box, to prevent the lenses that touch an injury; Before wrapping paper were open, not to put any pressure on the lens; Take out

from inside the box reflection lens and focus lens, should wear clean gloves, picking it from the side of the lens; Take off the lens on the wrapping paper, should avoid the content such as dust falling on the lens; Remove the lens, after spray gun to remove the dust on the mirror, and then put the lens on the optical lens from; Remove the lens and fixed support frame on dust and dirt, avoid by all means when other foreign bodies fall in lenses; Install the lens on the lens holder, don't pressure, so as to avoid the lens distortion; After the completion of the lens assembly,with a clean air spray gun to clear the dust on the lens and foreign bodies.

6.3.3 The steps of cleaning lenses

Different lenses, cleaning methods are different. When the mirror surface is flat and no mirror, use the lens cleaning paper, such as clean the mirror; When the mirror surface is curved or mirror with mirror, should use clean cotton swabs, such as clean the optics.

1).Clean the lens with lens paper steps: with a clean air spray gun blew the dust off the lens surface; Using alcohol to clean the surface of the lens or lens paper, avoid by all means use dry lens paper directly drag on the mirror, and lens paper should be flat on the surface of the lens, 2 ~ 3 drops of high purity alcohol or high purity acetone, slowly in the direction of the operator will lens paper horizontally, the movement for several times repeatedly, until the mirror surface clean; If the mirror is very dirty, lens paper can be folded in half 2 ~ 3 times, the above steps again and again, until the mirror clean.

2).Cotton swab to clean the lens of the steps: first use spray gun to blow off the dust on the mirror; Again with a clean cotton swab to remove dirt; With new stained with high purity alcohol or acetone swabs from the lens center along the circular motion, scrub lenses, each brush after a week, in another clean cotton swabs, repeat the above operation, until the lens clean, don't use have used cotton swabs to operate; With a clean cloth to clean the lens, remove residual marks on the mirror, be careful not to scratch the mirror; To clean the area where the good lens to get the light observation, if the reflection of the lens in good condition, suggests that the lens is clean, if the situation is bad, a reflection of the lens is to continue to clean the lens; Has been well clean the lens, according to the method described above, put the lens on the lens holder.

6.3.4 Storage of optical lenses

Optical lens properly stored, can keep the quality of the lens in good condition.

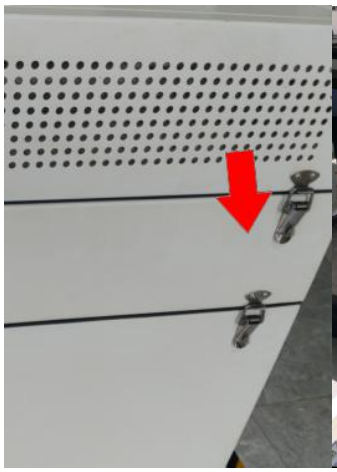
Store 10 ~ 30 ℃, environment temperature may not be the lens in the freezer, or a similar environment, otherwise freezes when taken out of cream, easy to damage the lens; Storage environment temperature is not more than 30 ℃, otherwise it will affect the coating on the surface of the lens.

Lenses will be stored in a box, the lens should be placed in the vibration environment, otherwise easy to cause deformation of the lens, thus influence on the performance of the lens to use.

6.4 Air filter maintenance

Check the air filter once a month.When the filter screen and filter elements getting black, please clean them in the following ways:

			Please wear dust mask,dust glasses and gloves when cleaning the air filter.

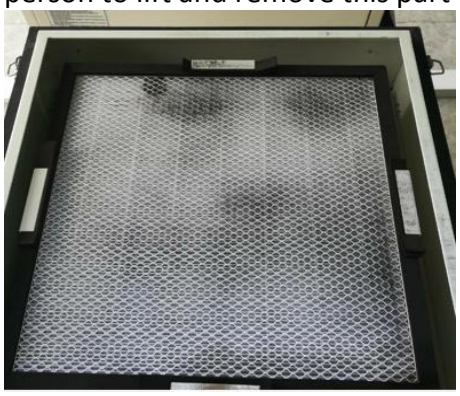


Picture 6-8

Picture 6-9

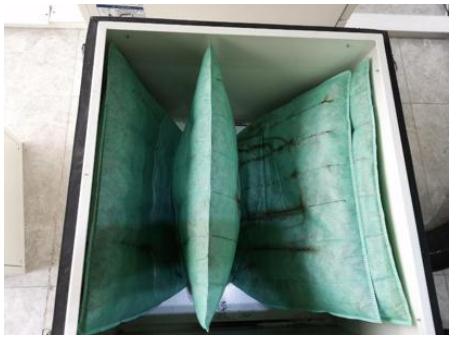
1.Unlock the all the buttons on the filter as the direction marked on picture 6-8.Then remove the “1” part on the picture 6-9 off the machine.

Caution:As the parts of the filter is more than 25kg ,the operator should find another person to lift and remove this part together.The



2. Dismantle the screws which fixed the filter screen, the use the dust collector to clean the filter screen.

Note: The air filter screen can’t cleaned by liquids.



3. Remove the filter element (green parts) in the “3” part and change a new one.

6.5 Machinery Lubrication

6.5.1 Lubrication of gear and rack

- Use rust inhibitor (**WD-40**) to clean up the gear and rack
- Use hand spray type butter(dinosaurs 192) to lubricate the gear and rack

6.5.2 Linear slide rail lubrication

- With the grease gun(R-301),put the lithium base grease(MP-3) into the centralized lubrication. As you know, without lubrication , there will be much friction on the linear slide rail , and this will reduce the slide rail's lifetime.
- The grease for linear slide rail and chain sprocket is lithium grease, we suggest you to use "Jinguan Lithim grease MP-3".With grease gun to inject grease into the slider(In addition, because of the structure--the linear guide rail is sealed in the dust-cover's bellows,we need open the dust-cover's bellows when you inject the grease)

6.6 Maintenance when you stop use the machine during long-time

When want to stop using the machine during a long time, for the moving parts, please butter them ,make anti-embroidered paper package.For other parts please periodically check if there's the rust phenomenon, and make the cleaning, anti-rust processes for the rusty parts(if conditions permit. You can add one dust-cover on the parts). In addition, please check and clean the machine regularly.

6.7 Storage conditions, storage period and matters needing attention

Machine tool storage environment should avoid the rain, moisture, tilt, rat, potholes, such as damage, and ensure the well ventilated, storage temperature within the range - 10 ℃ ~ + 40 ℃, relative humidity is not more than 70%. Transportation and storage time not more than 24 hours, allowing the environment temperature does not exceed 70 ℃. Prohibit put the machine in in open air for a long time. Because all sorts of reasons to temporarily store, truly besides should comply with the above requirements, should also check their condition and packaging, to ensure that the machine from damage.

6.8 Quick-wear parts list

Protective Mirror
Collimating lens
Brass nozzles
Focus lens

6.9 Waste treatment

Waste metal materials could be recycled. You can sold it to the local recyclable waste collectors.

The waste water in the water cooling machine can be discharged to the sewers.

The waste gas should be filtered by the air filter then exhaust to the air.

Chapter 7 Laser metal cutting machine warranty

<Laser metal cutting machine warranty>

First, thank you very much for the purchase of our products, in order to ensure the smooth progress of the service work of the product, especially as follows:

General

1. Warranty period, in line with the warranty conditions of the equipment will be free of maintenance

2. Users to use our equipment must ensure that equipment integrity, independence and the original factory. For the following the division will not warranty, also because of the resulting damage to the equipment or to our cause of economic loss of reputation and the division reserve right to pursue its legal responsibility

- Not consistent with the use of the equipment environment is still in use
- Unauthorized modifications to the equipment include the addition of a reduction, removal of replacement parts, or the use of our spare parts, peripheral equipment
- Failure to operate, maintains, or artificially damaged, as required.
- Because the equipment transported cause damage

1. We have no effect on the performance of the product, with no prior notice to change the product specifications and naming rights

2. Division I only on the sale of the product itself, the quality and performance of the legal obligations, does not assume other indirect obligations and responsibilities

Fine then

1. The whole machine is guaranteed for one year. Factory date from the date of the factory as a sign

2. Warranty of wearing parts:

Vulnerable parts are not in the scope of warranty, such as a variety of glass lenses, brass mouth, switches, crystal rods, foot switches, etc.

Power supply, drive motor, board warranty for one year

Machine peripheral equipment (if):

Peripheral equipment warranty for one year, to label product ex-factory date, by the equipment manufacturer according to the standard warranty, our assist maintenance; such as water cooler, fan, air compressor, computer and other(if have computer).

Parts maintenance Freight

1. within the warranty period, for a free replacement or repair of accessories, such as the need to return to factory inspection, repair, or replacement of, by the purchaser to bear the freight and send to company, the back testing plant for the quality of the product itself reason (reasons for non-human, non-use of

the environment, such as reasons), will give in order to free repair or replacement, also by our bear hair to the purchaser of the freight.

Repair parts should be returned to the factory inspection, by the division of customer service department detection, maintenance and then return to the buyer (buyers for various reasons in arrears with my spare parts, will cancel the guarantee of its equipment).

2. Within the warranty period, the quality of the non-product quality problems caused by equipment or accessories damaged, by the purchaser to bear the spare parts repair and transportation costs (such as the need to come home should bear the cost).

3. The warranty period, by the buyer from the freight and repair parts.

Postscript

This manual final interpretation is owned by our company, we will try our best to ensure the accuracy of the contents of this manual. Because of the editor's limited level, there maybe inappropriate or omissions,hoping to obtain the general readers and colleagues criticism and corrections.We don't assume any form of liability for all the consequences .