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Foreword

Thanks for choosing the optical fiber laser welder developed and manufactured by us. This User's Manual provides you with important information on safety, operation, maintenance etc. for use of the product. Please read this manual carefully and thoroughly before using the product.

Product overview

Laser welding is a new type of welding method as well as one of the important aspects of laser material processing technology application. It is mainly used for welding thin-walled materials and precision parts. The welding process belongs to the heat conduction type, which means that the surface of the workpiece is heated by laser radiation, and the surface heat is directed towards the internal diffusion through heat transfer. By controlling parameters such as laser pulse width, energy, peak power, and repetition frequency etc., the workpiece is melted to form a specific weld pool. This technology can achieve spot welding, butt welding, overlap welding, and seal welding, etc. Featured with including high depth-to-width ratio, small weld width, small heat affected area, less deformation, fast welding speed, smooth and good-looking weld seam, no need for treatment or simple treatment after welding, high weld quality, no pores, precise control, small focus spot, and high positioning accuracy.

Product appearance view and characteristics

Optical fiber laser welder

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(Subject to the physical product)

Product characteristics:

The handheld laser welder adopts a new generation of handheld welding gun to replace the traditional fixed light path, which is flexible and convenient, overcomes the limitations of the workbench space and the problem of automatic welding difficulty when the workpiece size is not uniform.

It is mainly used for welding large workpieces and welding fixed positions such as inner right angles, outer right angles, and flat welds.

The welding is featured with including small heat affected area, less deformation, large welding depth, and firm welding. Therefore, it is a new welding process for long-distance welding of large workpieces.

Laser welding can be used to weld parts that are difficult to access with great flexibility to perform non-contact remote welding.

Product advantages

1. The handheld welding gun replaces the conventional fixed light path, featured with more flexibility and convenience, achieving long-distance laser welding, and overcoming the limitations of the travel space of the workbench;
2. The handheld welding head is lightweight, flexible, and easy to operate, meeting the welding needs of multiple angles and positions;
3. Infrared positioning is adopted to check the position of welding joints and verify the position during welding, making the welding position more accurate and ensuring a more beautiful weld seam;
4. The laser welding depth is large and the welding is firm;
5. Not easy to deform, easy to grind and polish, solving welding quality problems such as welding penetration and weld beading caused by argon arc welding;
6. It is also suitable for spot welding of various complex welds and various devices.

Product application

1. Laser welding of sheet metals, cases and water tanks.
2. Laser welder for various hardware and lighting
3. Laser welding of door and window frames
4. Laser sealing welding of kitchen, bathroom, and washbasin hardware
5. Laser welding of billboards and advertising words

Suitable for most metals such as stainless steel, titanium, water plated plate, iron sheet, aluminum and copper materials etc.

Working environment

a) Please use this product in an environment of ambient temperature of 5 ℃~30 ℃, ambient humidity less than 85%, and without sharp temperature changes. Furthermore, please avoid use the product in the following places:

· Places with a lot of garbage, dust, and oil mist;
· Places with high vibrations and impacts;
· Places with access to medication;
· Places near high-frequency interference sources;
· Places prone to condensation;
· In environments with high concentrations of CO2, NOX, SOX, etc.

b) When the ambient temperature drops below 0℃, the water inside the equipment may freeze and the equipment may be damaged. Ensure that there is no icing inside the equipment for use.

c) In situations of rapid temperature changes, condensation, stains, and fog spots may occur on the laser device and optical lens. Therefore, it is important to prevent sharp environmental temperature changes. If it is difficult to avoid, please use the equipment after ensuring that there is no condensation.

Security information

Before using this product, please read and understand this Manual and become familiar with the information we provide for you. This Manual provides users with important product operation, safety, and other information as a reference. To ensure safe operation and optimal product performance, please follow the precautions and warnings below as well as other information in this manual during operation.

- This series of pulsed fiber laser devices are Class IV laser products. This series of laser devices emit laser radiation of no less than 200W within the wavelength range of 1,080nm or around 1,080nm. Avoid eye and skin contact with radiation directly emitted or scattered from the laser output head.
- Do not directly look at the output head, and ensure to always wear laser protective eyeglass when operating the machine.
- The light emitted by this laser device is invisible. When using it, do not face the laser output head towards anyone. Please wear laser protective eyeglass when the laser works.
- Please do not open the machine as there are no product parts or accessories available for the user to use. For any maintenance or repair, the machine must be returned to the manufacturer.

Laser device classification:
This series of laser device belongs to Class IV laser: direct laser irradiation will inevitably cause irreparable damage to the eyes, as well as skin burns and burning items. In some cases, the reflected and scattered light of the laser can also cause eye damage and skin burns.

Safety sign and location

The above two labels represent laser radiation, and we have attached this labels to the laser cover of the product near the fiber output port.

The **200W~1000W** laser device requires single-phase **220V±10%**, **50Hz** AC power; the **1500W** laser requires single-phase **380V±10%**, 50Hz AC power.

Caution:

1) It is necessary to ensure that the laser is reliably grounded to avoid potential personal injury during use.

2) There are no usable parts provided inside, and any repair should be carried out by the manufacturer's personnel. To prevent electric shock, please do not damage the label or remove the cover, otherwise the warranty terms will be invalidated for any damage to the product.

3) The laser output head is connected to the optical cable. Please handle the QBH output head carefully to prevent dust or other contamination in use. When cleaning the output lens, please use a dedicated wiping tool.

4) Failure to follow the methods specified herein for use of the laser device will weaken the protective function of the device. Therefore, this product must be used under normal environment conditions.

5) When the laser device is in operation, it is strictly prohibited to install the QBH output head.

6) The laser is cooled by water, and sufficient water flow must be ensured to dissipate heat.

7) Do not directly look at the OBH output head, and ensure to always wear laser safety glasses when operating the machine.

8) Power interruption poses great harm to the laser device. Please provide a continuous and reliable power supply.

9) It is strictly prohibited for the user to open the QBH window protector without authorization to prevent damage to the output head caused by dust and other contamination.

Precautions:

Before turning on the 220V or 380V AC power supply, make sure to connect the correct 220V or 380V voltage. Improper connection to the power supply will damage the laser device. Failure to use the controller or regulator within the scope specified herein will cause harmful radiation. It is important to align the laser output end and keep the lens at the output end clean. Please cover the collimator cover after use and do not touch the output lens. Do not use any solvents to clean the lens. If necessary, use lens paper to clean the lens. The loss of light may be due to failure to operate according to the above instructions, and such loss is not covered by the warranty.

Water chiller use precautions:

1) Drinking purified water can be used as cooling water. To prevent mold growth in the water in the chiller from causing pipeline blockage, it is recommended to add alcohol when refilling purified water at no more than 10% of the capacity of the purified water. Provide filtering devices as required for the chiller as necessary and clean them regularly.

2) When the operating environment temperature is high, to avoid condensation inside the laser device, please raise the water temperature of the chiller appropriately to avoid machine damage caused by condensation on the laser device. Such damage is not covered by the warranty.

3) When the laser is not in use for a long time, the internal water should be drained and the inlet and outlet should be sealed with the provided plugs to prevent pipeline blockage or damage to the laser device due to low-temperature freezing.

4) When the external environment temperature is low (below 0℃), please make sure to prevent the residual water inside the machine and QBH from freezing, which can damage the laser device. After the laser device is turned off, an air gun can be used to clean the residual water inside in a timely manner to prevent freezing.

Mode introduction

Work modes of the laser device are as follows:

1. Continuous mode: The emitted laser is continuous and can be used for cutting.
2. Pulse mode: The emitted laser is pulsed; when the pulse frequency is greater than a certain value, it is actually applied to control the average output power of the laser device (during pulse width adjustment and external control, the modulation signal corresponds to the mode).
3. External control: Separated from RS232 serial port control; specific parameter settings are set through the board and card software control interface.
4. Internal control: RS232 serial port control is acceptable; when RS232 serial port control is used, the control of the CNC board and cards becomes invalid.

Laser safety and protection

The emission wavelength of the GZ fiber laser device is around 1080nm, and the output power range can reach 30KW.

According to the European standard EN 60825-1, this series of laser devices belongs to Class 4 laser devices. This type of laser is an invisible infrared laser that can cause irreversible damage to the retina and cornea. And since the laser power emitted by the fiber output head is greater than 1,000W, it belongs to high-power laser for industrial processing application. Direct or indirect exposure of any part of the human body, such as the eyes or skin, to such high-power lasers can cause serious personal injury. Therefore, the relevant operators of the customer must wear suitable and certified lasering protective eyeglass throughout the operation of the laser device, and provide visible protective devices around the laser and processing machine to prevent accidents.

	When operating this product, the operator should ensure to wear laser protective eyeglass throughout the entire process. Laser protective eyeglass have laser wavelength protection selectivity. Users are kindly requested to choose ones matching the laser output wavelength of this product. When the laser device is powered on (regardless of whether it is in a light emitting state), even if the operator wears protective glasses, it is strictly prohibited to directly observe the output head; when it's necessary to check, the power must be turned off first.

Laser protective eyeglass with a protective wavelength of 1um

Electrical safety

a) Do not damage the power wires and cables. Do not step on, twist, or pull the cables. Cable damage can cause electric shock, short circuit, and fire.

b) For any burnt odor, abnormal noise, abnormal heat, smoke or other abnormal phenomena, please turn off the power to stop operation and immediately contact us, otherwise there is a risk of electric shock, fire, and other hazards.

c) Foreign objects, especially metal or conductive objects should be avoided inside the equipment to prevent short circuits or faults.

d) Do not use this device in a damp environment, as electrical contact with water may cause electric shock or short circuit.

e) When replacing the laser xenon lamp, be sure to cut off the power supply of the welder.

f) Do not connect the equipment to the power supply when it is not in operation.

Material safety

a) Please wipe the external stains of the system with a dry or slightly damp cloth, and if necessary, wipe with diluted neutral detergent or alcohol. Please do not use special solvents, gasoline, etc., as this may cause

structural deformation or surface discoloration.

b) Avoid placing containers containing liquids on the machine. Spilling water can damage insulation, and corrosive liquids can corrode the equipment.

Fire safety

a) It is prohibited to stack flammable and explosive materials and debris around the machine. Sparks may splash out during welding, causing a fire with combustible materials.

b) Flammable and explosive materials shall not be placed on the optical path or in areas where laser beams may be irradiated. Irradiation of laser beam on flammable and explosive materials may cause fire or explosion.

c) Do not cover the equipment in use with blankets, cloth, or other textiles to prevent the equipment from heating and causing fire.

d) Once the machine catches fire or explodes, be sure to cut off all power sources and use carbon dioxide, dry powder fire extinguishers, or dry sand to extinguish the flames.

Installation and commissioning

Installation environment

Power supply for the machine:

Power grid fluctuation ＜ 5%

Power supply frequency 50Hz, single-phase 220V, 10A

The grounding wire of the power grid meets the national standard requirements for machine room

Cooling water: Deionized water or pure distilled water kept clean

Notes: 1. Leakage protection or air switches must be installed.

2. It is necessary to have a power cable of more than 4mm^2, and the three colors of the neutral, live, and ground wires must be different.

3. It must be grounded

4. If there are significant fluctuations in the power grid and nearby equipment that affects voltage is operating, it is recommended to use a voltage regulator to ensure equipment stability

During the installation process:

a) Please designate personnel with sufficient knowledge and experience in lasers and laser devices as equipment management personnel.

b) This equipment must be installed in a fixed and horizontal location, tilting or toppling over the device will cause malfunction.

c) This equipment is a strong current equipment, and the installation personnel must be qualified electrician and wire the equipment in accordance with national electrician regulations. It is not allowed to

power on the equipment until it is installed. Power on and start the machine only when safety is ensured.

d) Please be careful when operating switches and buttons by hand. Improper operation or using objects such as screwdrivers or pen tips can cause equipment malfunction or damage.

e) Please be careful to operate switches, buttons, etc. one by one in order to avoid switching multiple switches at the same time causing equipment malfunction.

f) The outer plate and cover are respectively connected together with grounding wires and the equipment body. After removed outer panel and cover are restored to their original positions, please make sure to reconnect the ground wire.

The detailed specifications and parameters of the high-power fiber laser device developed and manufactured by us are shown in the table below

Table 1 Product Specification & Parameter Table

Item	Parameters	Test environment
Optical characteristics		
Rated output power (W)	1000 W	Rated power output
Polarization direction	Random polarization	--
Power regulation range (%)	10-100%	--
Center wavelength (nm)	1080±3 nm	Rated power output
Output power instability (%)	≤±2%	Continuous operation for 1,000 hours: Operation temperature: 25℃
Modulation frequency (KHz)	50 KHz	Rated power output
Optical output characteristics of QBH output head		
Optical quality (M^2)	＜1.3 (Output core diameter 15 um)	Rated power output
Numerical aperture	＜0.1	Rated power output
Fiber core diameter (μM)	15 um	--
Output fiber length (m)	15 m	Customizable length
Electrical characteristic		
Operating voltage	200-240VAC, 50/60Hz, single-phase three wire	--
Maximum power consumption (W)	4 KW	Rated power output
Control mode	Analog 0-10V (external control mode) RS-232/RS485/TCP (internal control mode)	--
Working mode	Continuous/modulation	--
Water cooling conditions		
Laser device cooling water temperature	18-26℃±1℃ (Specific settings can be based on ambient temperature)	--

QBH output head cooling water temperature	25℃-32±2℃ (Specific settings can be based on ambient temperature)	--
Laser device cooling water flow rate	≥10L/min	--
QBH output head cooling water flow rate	2L/min≤QBH flow ≤4L/min	--
Cooling water pressure	2.5bar≤ water pressure ≤3.5bar	--
Other characteristics		
External dimensions (L×W×H, mm)	780×483×207 mm	--
Weight (kg)	68 kg	--
Working environment temperature range (℃)	10-40 ℃	--
Working environment humidity range (℃)	＜85%	--
Storage temperature (℃)	-40-75℃	--

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Schematic diagram for installation and use of fiber optic welding

(subject to the actual model)

Step 1: Fill the water tank with water

Open the front cover of the cabinet, fill the water tank with pure water until above the green line for the first use.

Note: The water level should not exceed the green line, and it should be changed at least once a month.

To ensure the safety of equipment use, the laser cooling system needs to meet the following requirements:

1. Cooling water can be distilled or purified water, and distilled water is recommended;
2. When starting the cooling system of the chiller for the first time, the entire water system and joints should be checked for water leakage. External water pipes must be installed and connected according to the marks on the water inlet and outlet of the laser device;
3. To prevent the growth of microorganisms and molds in the water of the chiller from causing pipeline blockage, it is recommended to replace the cooling water every 3-4 months to ensure the quality of the cooling water; the customer is not suggested to add antibacterial agents casually;
4. When the ambient temperature of the equipment is between -10℃ and 0℃, antifreeze must be used (please consult the after-sales department for specific models) and replaced every 1-2 months. When the ambient temperature of the equipment is below -10℃, a chiller with heating function must be used, and the chiller must be guaranteed to operate uninterrupted for 24 hours to prevent the cooling water from freezing.
5. If the laser is not used for a long time, the cooling water inside the cooling system and the laser device should be drained, otherwise it will cause damage to the laser equipment. Please use compressed air with a pressure less than 0.3MPa for emptying, otherwise it may cause irreparable damage to the water cooling system.

Step 2: Connect the power

The yellow and green wire is the ground wire. If the red and blue wires are two-core wires, they should be connected to a 220V power supply, with one neutral wire and one live wire. If they are four-core wires, they should be connected to a 380V power supply, with three neutral wires and one live wire.

Note 1: The neutral wire must be connected correctly.

Note 2: Users who choose a 380V power supply should contact the manufacturer for wiring.

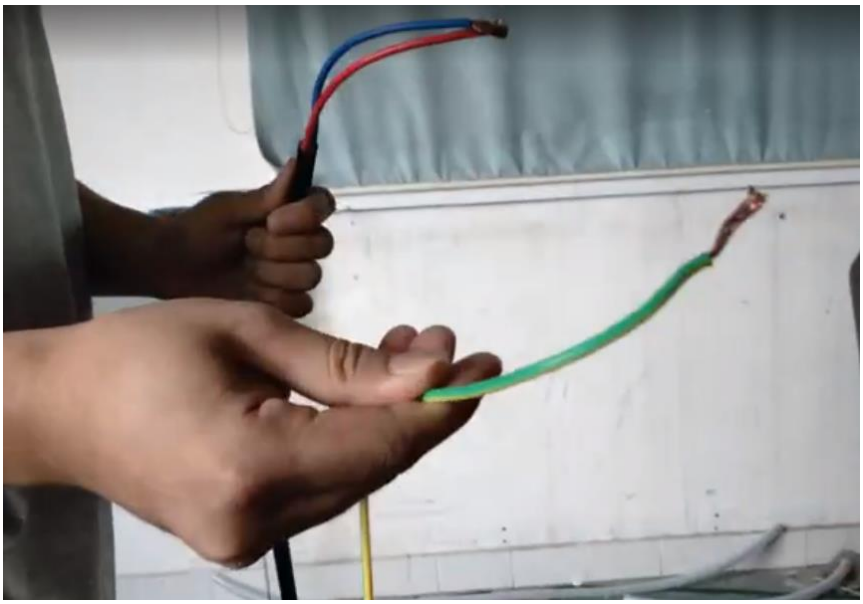
1. When wiring the laser device power supply, it is necessary to ensure a reliable and effective grounding connection to avoid electric leakage and electric shock;

When the laser power supply is not disconnected, it is strictly prohibited to plug, unplug, or install the QBH output head to avoid laser injury;

3. The QBH output head of the laser needs to be handled gently and must be dustproof. Before use, please carefully check the condition of the output end face to prevent dust or other contamination. When cleaning the output end face, please use special lens paper. For specific operation methods, please refer to "Chapter 6 Fiber Optic Connector Inspection and Cleaning Guidelines";

4. Do not directly look at the output head, and ensure to always wear laser safety glasses when operating the machine.

5. If the laser is not used according to the methods specified herein, it may be in an abnormal working state and cause damage, which will not be covered by the warranty terms of the manufacturer.



Step 3

Turn on the main power supply on the left side of the rear of the machine, with undervoltage and overvoltage protection on the right side, which will pause for approximately 30 seconds.

Press the first button on the left side of the lower row, which is the power

button.

Note: The red button above is the emergency stop button

Turn on the laser switch and turn it to the "REM" position on the left. The green indicator "POWER" on the left indicates normal operation (please refer to the actual laser device).

Step 4: Adjust the parameters as required

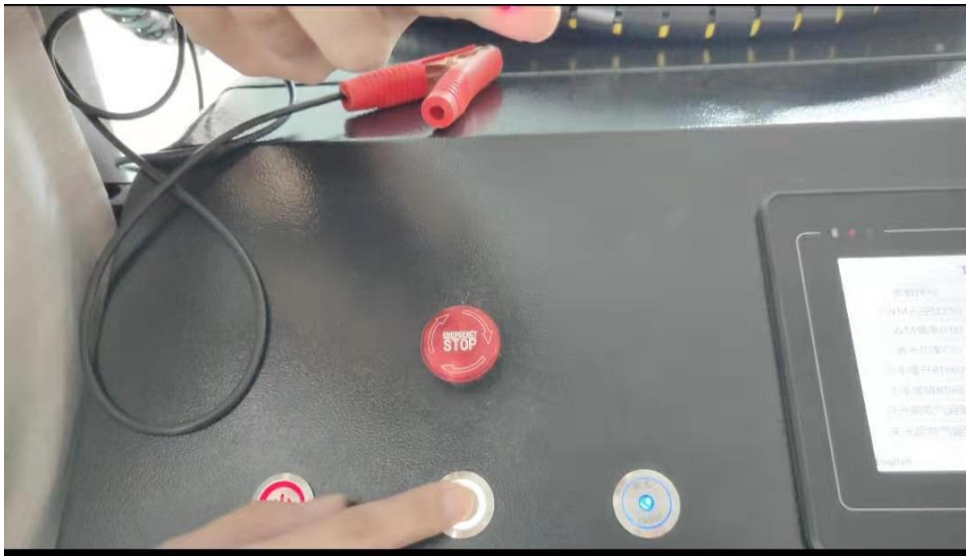
Press Enable laser - Adjust parameters - Set


激光焊接控制系统
V1.43
激光
功 率
60
%
占空比
80
%
频 率
20000
hz
缓升时间
0
ms
缓降时间
0
ms
保护气
提前吹气
100
ms
延时吹气
100
ms
工作状态
停止
安全信号
出光信号
打点模式
时长
100
ms
激光使能
关闭
开启
电机
振镜
语言

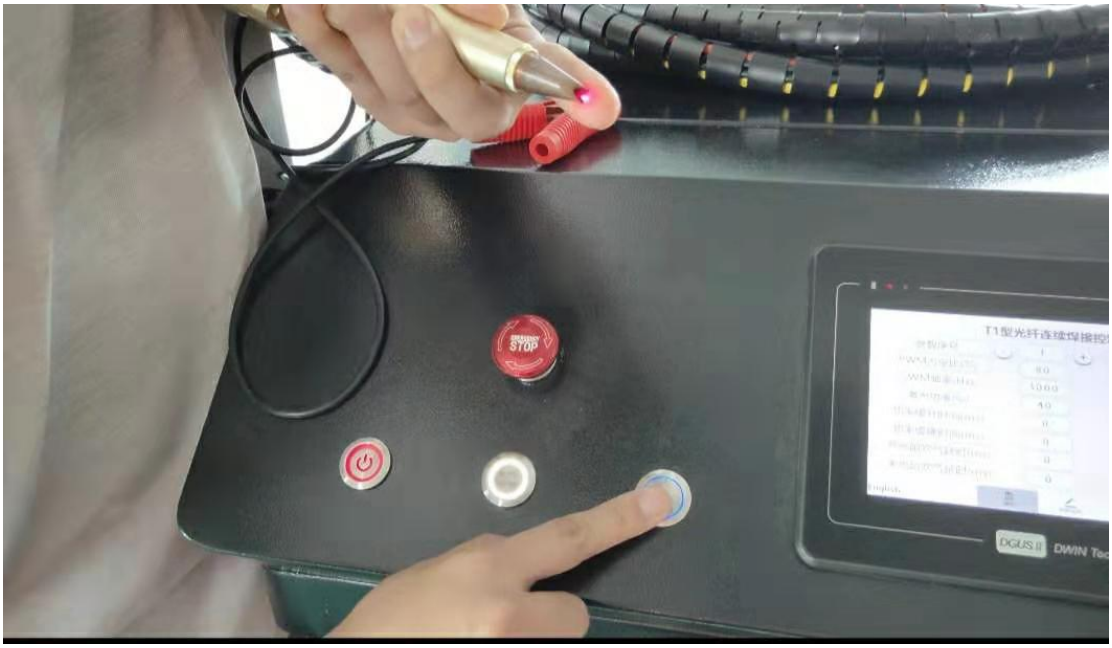
Hold the gun in hand, red light indicates the laser device is normal.

Turn on the lower motor switch and the red light rotates.

Note: If the swing function is not needed, it can be turned off.



Turn on the Start switch



Hold the gun switch, output means the installation is completed.

Note: The red clamp should be connected to the ground wire. To prevent light errors, it must be clamped onto the metal workpiece.

Use of software

Software interface

Function module	Function	Description	Remarks
Laser	Power %	Laser device output power percentage setting	
Laser	Duty cycle %	Duty cycle setting for laser PWM modulation	Range 1~100, when the value is 100, the laser continuously outputs, and frequency modulation does not work.
Laser	Frequency	Output frequency setting for laser PWM modulation	Range 10~50000
Laser	Ramp-up time	Time required for power to slowly increase from 0 to set power (calculated from the start of laser energy activation).	
Laser	Ramp-down time	The time required to reduce the power to 0 (calculated from the moment the laser energy output is turned off).	Both the ramp-up and ramp-down curves are linear.
Shielding gas	Pre-blow	Turn on the shielding gas delay time, then turn on the laser again	
Shielding gas	Delayed blow	After turning off the post laser delay time before turning off the shielding gas	
Working state	Working state	Showing the current state of the device	**No safety signal detected during malfunction**
Spotting mode	Laser is output once every press	Time controllable	
Laser enabling	Laser enabling	Laser on/off	Laser output is only allowed when turned on
Motor	Swing motor	Rotary swing welding function	
Galvanometer	Swing motor	Swing welding function	
Language	Display language switching	Switching between multiple languages	

Touch the desired language - Return

Please refer to the handheld gun for motor and galvanometer parameters

Fault diagnosis

S/N	Fault code	Fault cause	Remarks and actions
1	0010	Excessive light return alarm	Materials cut by the laser device has strong return light. Please use the laser device with caution. It is recommended to continuously work for no more than 2 hours when cutting high reflection materials to ensure the normal service life of the laser device, cutting head, and other related accessories. Please check if the cutting head nozzle is blocked by metal debris and clean the nozzle in a timely manner.
2	0020	Forward PD fails to detect laser	The reasons for this fault include: 1. Abnormal control signal, enabling and modulating without analog quantity or analog quantity too low, and analog quantity must be output earlier than enabling and modulating. 2. No laser detected, low peak power, low average power. 3. The internal setting value of the laser is too high, and the parameters can be calibrated or equipment can be returned to the factory for maintenance.
3	Temp	Pump source or water cooling temperature is too high	Please check if the set temperature of the water cooler meets the requirements. Long term operation of the laser device can also cause heat accumulation and excessive temperature. The machine can be stopped for cooling before use.
4	0001-0006	Pump source power supply current too high	The internal overcurrent fault of the laser device will appear when the "0-10V" DA value exceeds the limit value. Please check whether this setting is normal.
5	QBH	QBH not connected properly	Normally, if the QBH is not inserted into the cutting head, this fault will be reported. Please check if the QBH head is properly inserted.
6	Stop	E-stop switch is pressed	After the emergency stop switch is pressed, it can be released. The laser device needs to be restarted before it can function normally again.
7	Flow	Flow alarm	The water flow of the chiller is small or no water is available. Please check whether the chiller system works normally.

(subject to the actual laser device provided)

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Problems during welding process

Spattering is most likely to occur in laser welding, especially in high-power welding. Particles generated by spattering will also attach to the weld pool and workpiece surface, which is very easy to cause surface roughness changes, scratch the base metal, contaminate the optical medium such as the eyeglasses, spacers, filters and frosted glass sheets, and even cause rework of parts, damage to components, and even personal safety and property losses of the Company.

Especially the automobile industry needs to use laser welding technology to process galvanized steel, copper, aluminum and other specific materials. The way to eliminate spatter is to sacrifice the inherent advantages of the fiber laser device, but this will reduce the processing efficiency. Therefore, it is necessary to understand the generation of spatter in order to minimize the impact of spattering.

1. How is spatter formed?

What's spatter? Spatter is the molten metal that flies outside the weld pool. After reaching the melting temperature, the metal material changes from solid to liquid, and further heating will transform it into a gaseous state.

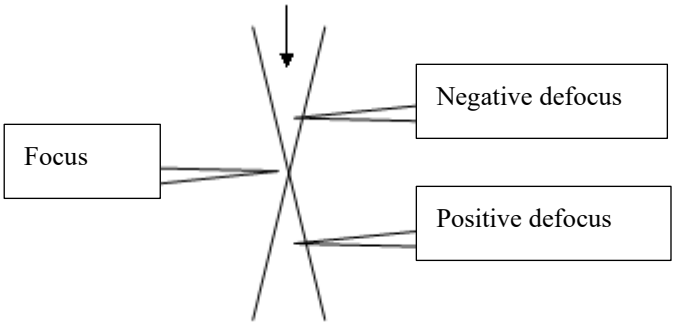
When the laser beam continuously heats, the solid metal becomes liquid, forming a weld pool. Next, the liquid metal in the weld pool is heated again and "boils". Finally, the material absorbs heat and vaporizes, while boiling causes a change in internal pressure, bringing out the surrounding liquid metal, ultimately resulting in "splattering".

As we can see from the figure, the laser continuously acts on the material, causing it to undergo intense vaporization and expansion, generating pressure, and forming a molten material (left figure). Then, when the metal vapor escapes, high pressure is generated to push the material towards the top of the keyhole (as shown in the middle figure). Finally, the splatters are pushed out of the top of the keyhole and attach to the surface to form molten material (right figure).

How to control spatter?

Laser focus position selection:

Focus lens



Focus position: the minimum point of the spot diameter and the maximum and strongest point of energy
It can be used during spot welding, or when the energy is low and the minimum required point is needed
Negative defocus position: The larger the diameter of the spot, the spot becomes larger as it moves away from the focal point
Suitable for continuous deep penetration welding and spot welding
Positive defocus position: The larger the diameter of the spot, the spot becomes larger as it moves away from the focal point
Suitable for continuous surface sealing welding or welding with low penetration requirements

Note: The positive focal length is the position where the laser flame is the most intense and the sound is the clearest.

General process control for continuous penetration welding: If slight discoloration marks can be seen on the back of a single point, good penetration welding can be achieved during continuous welding. If obvious marks are visible on the back, and even penetration can be felt, spatter and even a deep pit may appear during continuous welding. In specific cases, it is necessary to adjust the focal length, energy size, and waveform based on the actual sample.
The thinner the material, the smaller the light spot required, otherwise it will be welded through.

We can significantly reduce the process problems and lens burning caused by splattering by adopting positive or negative defocusing methods!

Welding Process Parameter Table

Aluminum	Laser device (W)	Power (W)	Speed (mm/s)	Frequency (KHz)	Focal point (mm)
1mm	500	480	700	20	+1
1.5mm	1000	560	800	20	+1
2mm	1000	780	800	20	+2
2.5mm	1000	920	800	20	+2
3mm	1500	1150	800	20	+2

Brass	Laser device (W)	Power (W)	Speed (mm/s)	Frequency (KHz)	Focal point (mm)
1mm	1000	900	600	30	+3
1.5mm	1500	1100	600	30	+4
2mm	1500	1350	500	30	+4
2.5mm	2000	1600	500	30	+5
3mm	2000	1850	500	30	+6

Red copper	Laser device (W)	Power (W)	Speed (mm/s)	Frequency (KHz)	Focal point (mm)
1mm	1000	650	600	30	0
1.5mm	1000	850	600	30	0
2mm	1500	1100	500	30	0
2.5mm	1500	1400	500	30	0
3mm	2000	1750	500	30	0

Carbon steel	Laser device (W)	Power (W)	Speed (mm/s)	Frequency (KHz)	Focal point (mm)
1mm	500	300	500	20	0
1.5mm	500	370	500	20	0
2mm	500	480	600	20	+1
2.5mm	1000	600	600	20	+1
3mm	1000	760	700	20	+2

Galvanized sheet	Laser device (W)	Power (W)	Speed (mm/s)	Frequency (KHz)	Focal point (mm)
1mm	500	320	600	20	0
1.5mm	500	460	600	20	+1
2mm	1000	600	500	20	+2
2.5mm	1000	800	700	20	+3
3mm	1000	960	650	20	+3

Due to differences in equipment configurations and welding processes (machine tools, water cooling, environment, boards and cards, and gas pressure) used by different customers (gas N2/Ar), this data is for reference only.

Regular maintenance by the customer

Recommended maintenance items	Recommended contents	Estimated time consumption
Check if the water level in the tank of the chiller is between the scale MIN and MAX	1-2 weeks	10min
Check the quality of cooling water (whether there are microorganisms growing or the water becoming turbid)	Monthly	10min
Replace cooling water	Quarterly	30min
Replace the cooling water filter	Determine whether to change water based on whether it is contaminated	30min
Check the cleanliness of the laser and external components	Quarterly	15min

Chiller operation instructions

Room 702-0005, Building 15, Xi Zhang first village, Diaotai Sub-District Office, Fengxi beyolu, Xixian new Area, Shaanxi Province, China
Lasermanufacture.com Tel: +008615825503113

Technical parameters

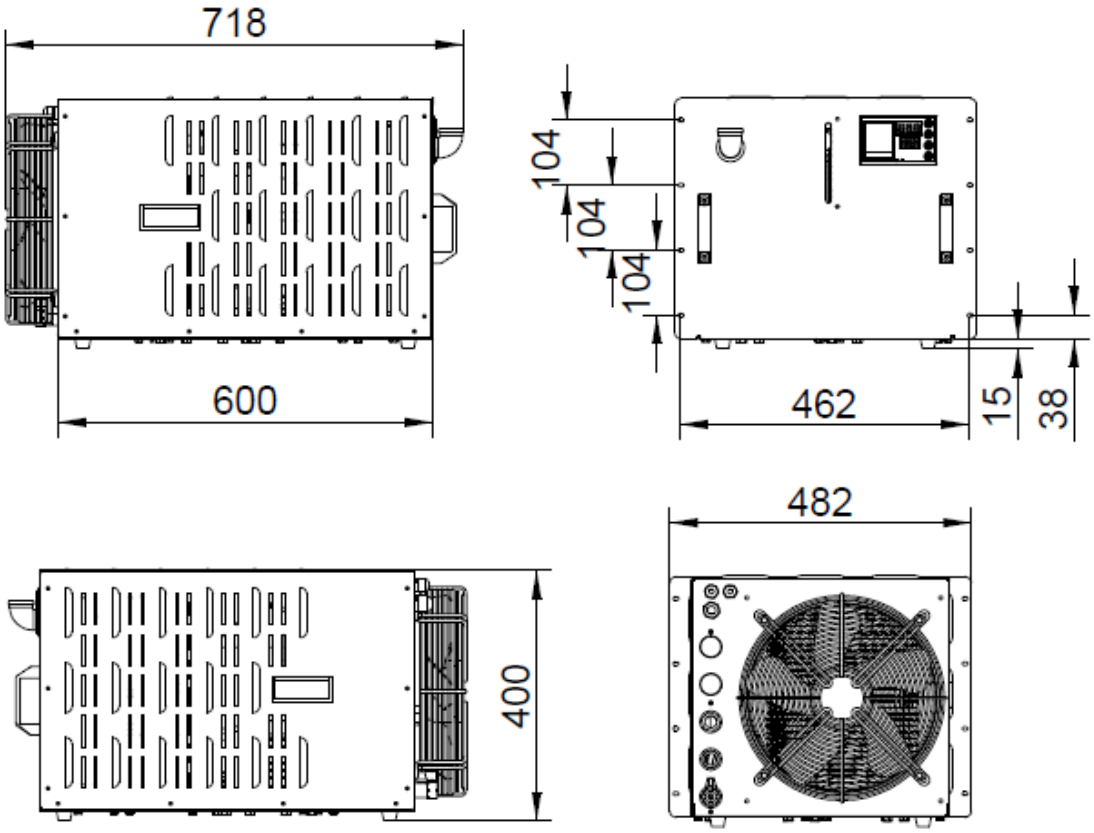
Model		Unit	CC-015AAST40-A02-1500
Refrigerating capacity		W	3600
		BTU/h	12276
		Kcal/h	3096
Rated total power		W	3000
Power supply			220V/3N~50Hz
Refrigerant			R22
System throttling method/cooling capacity regulation method			Capillary/hot gas bypass
Compressor motor power		W/HP	1155/1.5
Auxiliary power of electric heating tube for room temperature water		W	1200
Fan power		W	89
Water tank volume		L	8.5
Room temperature water line	Control precision	℃	±1
Chilled water pump	Control precision	℃	±0.5
	Power	W	550
	Lift	M	24-44
	Flow	L/Min	13.4-66.7
Field of application	Ambient temperature	℃	5-40
	Room temperature water line	℃	20-35
	Chilled water line	℃	8-35
Alarm value for room temperature water flow			≤0.4L/Min cut-off
Alarm value for chilled water flow			≤2.0L/Min cut-off
Inlet and outlet connector of room temperature water		Inch	4' internal thread
Chilled water inlet and outlet connector		Inch	4' internal thread
Drain outlet		Inch	4' internal thread
Noise value		dB/（A）	＜60
External dimensions L×W×H		mm	718×482×400
Net weight		kg	58
Chassis			Shockproof foot pad

☆ The above technical parameters are based on ambient temperature: 30℃; Outlet water temperature: 22℃;

☆☆ Safety protection: protection for low water temperature, protection for high water temperature, and protection for two-way water flow.

Outer dimension:

外形尺寸：



Room 702-0005, Building 15, Xi Zhang first village, Diaotai Sub-District Office, Fengxi beyolu, Xixian new Area, Shaanxi Province, China
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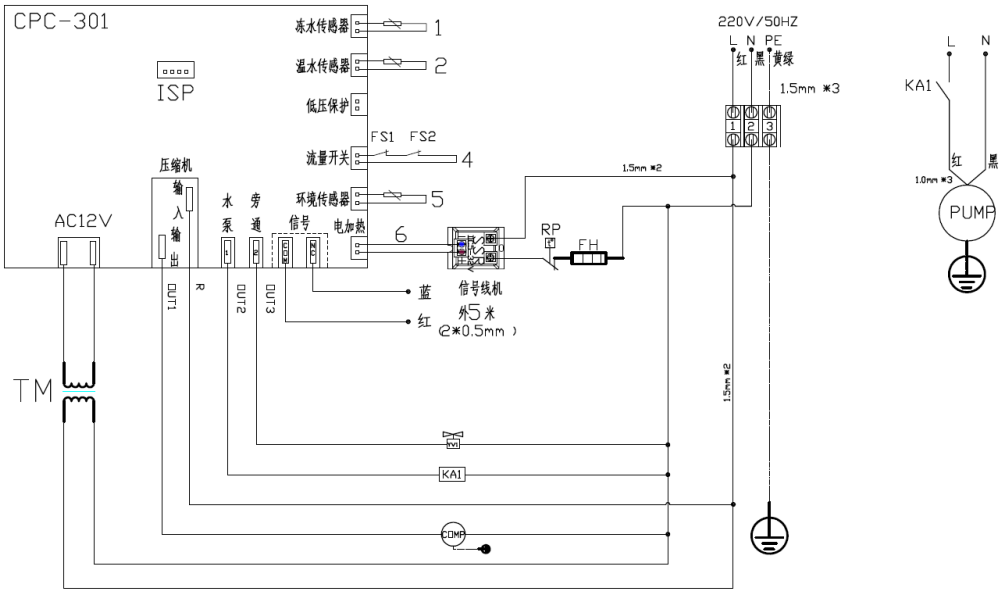
Circuit diagram AAST40-A02-1500

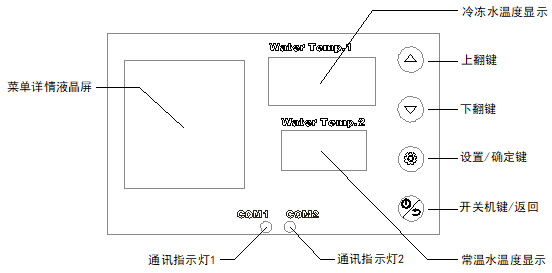


冻水传感器	Chilled water sensor
温水传感器	Warm water sensor
低压保护	Low voltage protection
流量开关	Flow switch
环境传感器	Environment sensor
电加热	Electric heating
信号	Signal
旁通	Bypass
水泵	Water pump
压缩机	Compressor
输入	Input
输出	Output
蓝	Blue
红	Red
黑	Black
黄绿	Yellow green
信号线机	Signal wire
外 5 米	5m from the machine

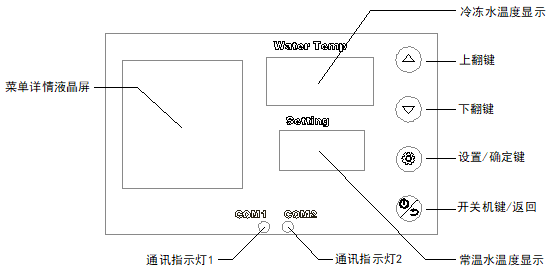
KA1: Intermediate relay; SSR: Solid-state relay; TM: Single-phase transformer

COMP: Compressor; FAN: Condensate fan; PUMP: Chilled water pump
YV1: Bypass solenoid valve
FS1: Chilled water flow switch; FS2: Room temperature water flow switch
RP: Temperature protection switch; FH: Electric heating tube

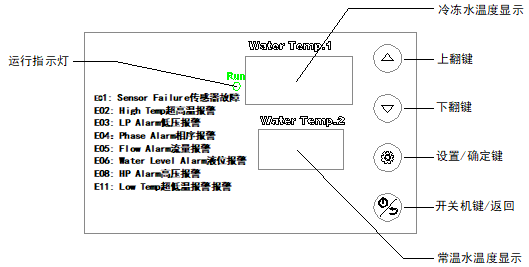
Temperature controller operating instructions



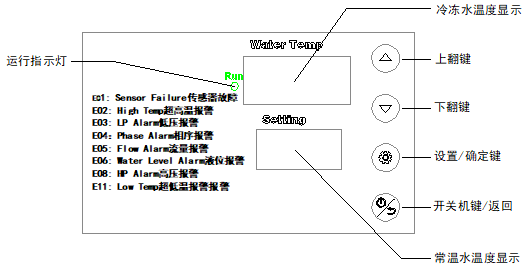
双温显示详情



单温显示详情



双温显示详情



单温显示详情

冷冻水温度显示	Chilled water temperature display
上翻键	UP
下翻键	DOWN
设置/确定键	Set/OK
开关机键/返回	On/Off Key/Return
常温水温度显示	Temperature display for room temperature water
通讯指示灯	Communication indicator
菜单详情液晶屏	Menu details LCD
双温显示详情	Dual-temperature display details
单温显示详情	Single-temperature display details

运行指示灯	Operation indicator

Single-temperature mode

Hold Set key to enter temperature difference setting

The upper digital display shows P-------- " the lower digital display shows the temperature setting value, adjust with Up and Down keys.

Press Set key -> the upper digital display shows C -> The lower digital display shows temperature difference setting

Hold the Up and Down keys simultaneously to enter Administrator Settings, and press Set key to switch

LT-> Low temperature alarm value

HT-> High temperature alarm value

CA -> Sensor compensation

T1 -> The compressor stop & start delay, which must be set for more than 2 minutes

F1 -> Mode setting, 1: Cooling only, 0: Constant temperature

F2 -> 0: Power on for standby; 1: Power on to start up; 2: Automatic recording

E3 -> Low pressure alarm enabling (1: alarm enabled; 0: alarm disabled)

E5 -> Flow alarm enabling (1: alarm enabled; 0: alarm disabled)

E6 -> Level alarm enabling (1: alarm enabled; 0: alarm disabled)

E8 -> Hi-pressure alarm enabling (1: alarm enabled; 0: alarm disabled)

At -> Synchronous environmental regulation enabling (1: Enabled; 0: Disabled)

Dual-temperature mode

Hold Set key to enter temperature difference setting

The upper digital display shows P-------- " the lower digital display shows the temperature setting value for chilled water, adjust with Up and Down keys.

Press Set key -> the upper digital display shows P1---> The lower digital display shows warm water temperature setting

Press Set key -> the upper digital display shows C -> The lower digital display shows temperature difference setting for chilled water (set as 0.1). The temperature difference setting for cooling-only mode must be over 1.

Hold the Up and Down keys simultaneously to enter Administrator Settings, and press Set key to switch

LT-> Low temperature alarm value

HT-> High temperature alarm value

CA -> Sensor compensation

T1 -> The compressor stop & start delay, which must be set for more than 2 minutes

F1 -> Mode setting, 1: Cooling only, 0: Constant temperature

F2 -> 0: Power on for standby; 1: Power on to start up; 2: Automatic recording

E3 -> Low pressure alarm enabling (1: alarm enabled; 0: alarm disabled)

E5 -> Flow alarm enabling (1: alarm enabled; 0: alarm disabled)

E6 -> Level alarm enabling (1: alarm enabled; 0: alarm disabled)

E8 -> Hi-pressure alarm enabling (1: alarm enabled; 0: alarm disabled) invalid

At -> Synchronous environmental regulation enabling (1: Enabled; 0: Disabled)

UP: During parameter setting, press this key to increase by 1 or 0.1, and hold it to quickly and continuously increase;
DOWN: During parameter setting, press this key to decrease by 1 or 0.1, and hold it to continuously decrease;
Set/OK: In normal operation mode, holding it (pressing) can enter user temperature difference setting (parameter setting, during parameter setting, pressing it can confirm the current parameter or option);
Return/On/Off: In standby mode, press this key to turn on the machine; under normal operation, hold this key to shut down the machine (while setting parameters, press it to save and exit).
※ **User parameter setting**: Only the temperature difference needs to be set. Without confirmation of the manufacturer, it is prohibited to modify other parameters of the temperature controller.

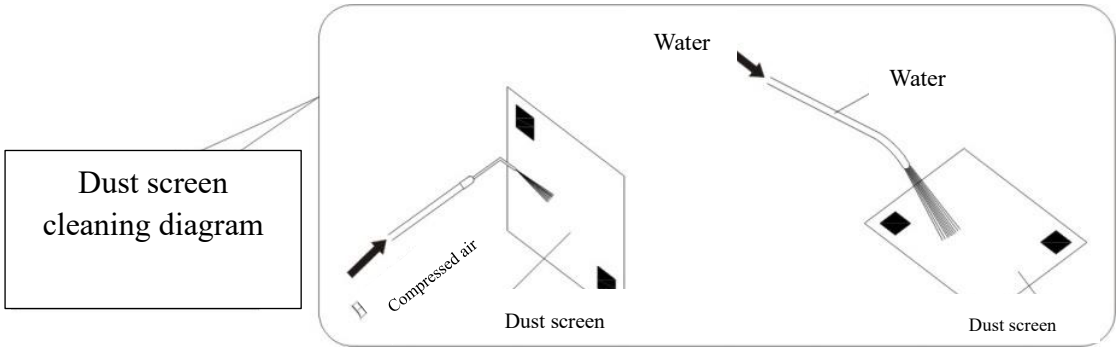
11. Troubleshooting

Warning: Maintenance should be carried out by personnel qualified for the work. After the power is turned on, it is necessary to be extra careful when measuring voltage with electricity.
（1) The machine does not work
Confirm the power cord is connected to the power supply terminal.
Confirm the power switch is turned on.
Confirm the panel is powered on.
(2) The pump is out of normal work.
Check the liquid level of the entire system to ensure that the water pump can work normally.
Check the water pump motor is running and the circulation system is not blocked.
Check the voltage is normal.
Check if the fluid viscosity is too high.
Check if the connecting pipe is restricted.
(3). No cooling or insufficient cooling.
Check if the voltage is too low or too high.
Check if the air outlet and air inlet are blocked.
Check the ambient temperature. High ambient temperature can cause the refrigeration compressor to shut down for a short time.
Check if excessive heat is transferred to the coolant, as this will exceed the cooling effect of the refrigeration system.

12. Maintenance

The chiller requires minimal regular maintenance:

To maintain the optimal cooling capacity of the system, the radiator, ventilation holes, and filter screen should be kept clean and free of dust. The dust on the dust screen should be regularly removed. Remove the dust from the screen with air gun, water pipe, etc. The cleaning method is shown in the figure. Clean oily dirt with a neutral detergent. Before reinstalling the dust screen, it should be dried. Regular cleaning of the dust screen can extend the service life of the chiller and reduce the consumption of electrical energy by the chiller.



Professional personnel are required to inspect each connection every half month for any looseness and water leakage.

Professional personnel are required to check every half month for any loose connections and poor contact at each wiring point.

Regularly clean the water tank, (rinse or replace the filter element) clean the water outlet, install a stainless steel Y-shaped filter tee, and replace the circulating water to ensure the cleanliness of the water system.

Regularly check whether water refilling is needed. Usually, the water level in the water tank should be over the coil pipe in the tank, otherwise, water refilling is needed;

Regularly change the water according to the water quality. If the water flow rate of the pump is too low that is caused by air inside the pump, open the exhaust hole of the pump in shutdown mode to discharge the air or unplug the water outlet of the chiller to drain the air. Air bubbles in the water path will reduce the light transmittance of the water. When there are air bubbles in the transparent hose or at the return port of the water tank, it is necessary to check whether the return pipeline is air-leaking and whether the water level in the tank is low.

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Safety warning

CAUTION

Installation and maintenance shall be done by professional technical personnel complying with local installation and maintenance regulations and being richly experienced in installation and maintenance of this model. The Manufacturer shall not be liable for any damage to the unit or personal injury caused by violation of this provision.

WARNING

Sharp edges and coil surfaces are both harmful and should be avoided from contact.

WARNING

If the chiller is not powered on or running for a long time, in an environment of ≤ 0℃, the water side heat exchanger, water in the tank, and water pipe may freeze and cause the heat exchanger, water tank, and water pipe to break.

WARNING

Moving the machine and coming into contact with the power supply are very dangerous, which can cause injury or death. Before maintenance, the main power supply must be cut off.

CAUTION

The main power switch should be set at a height of 1.4 meters or more (out of reach of children) to prevent accidents when children come into contact with the power switch.

CAUTION

If the safety protection device is frequently activated, please contact us immediately to troubleshoot before use.

CAUTION

This chiller can only be used in a safe indoor environment to avoid splashing water inside the chiller, otherwise it may cause damage to the chiller.

Laser antifreeze protection (mandatory for users)

In severe winter weather, when the air temperature is below 0°C, liquid water will condense to form a solid, during which its volume will increase, "cracking" the pipelines and components in the water cooling system (including the chiller, laser, and output head). During installation and debugging, the laser device should be filled with antifreeze before use. After commissioning, please make sure to fill antifreeze to the QBH output optical cable and laser device, then store or send them to the customer to avoid freezing damage during storage and transportation. How to prevent the laser device from being damaged by freezing is a key issue in winter maintenance. We inform you of the antifreeze protection measures and freezing hazards of using the laser in winter, and please remind your customers again to avoid losses.

I. If there is absolutely no power outage in the local area, the chiller should not be turned off at night. At the same time, in order to save energy, the temperature of low and normal temperature water should be adjusted to 5-10 ℃ to ensure that the coolant is in a circulating state and the temperature is not lower than the freezing point.

II. Using antifreeze as coolant

Antifreeze must be used in case the operating environment frequently experiences power outages and does not have the conditions for daily coolant drainage. The basic liquid of antifreeze is generally composed of alcohols and water, requiring high boiling and flash points, high specific heat and conductivity, low temperature and low viscosity, less foaming, and no corrosion of metal parts, rubber hoses, etc. When selecting or mixing antifreeze, its freezing point should be 5℃ lower than the minimum temperature of the usage environment.

1. It is necessary to add professional brand antifreeze to the chiller, such as Clariant AntifrogenN, with a ratio of 3:7 (3 for antifreeze and 7 for water). After adding antifreeze, the system can operate in an environment of -20℃ without freezing. If the temperature is below this range, please consult the chiller supplier to confirm the antifreeze ratio. If it is not convenient to purchase professional brand antifreeze, a large bottle of car antifreeze such as Shell OAT-45℃ can be purchased for direct use in the laser water cooling system. The dilution ratio can be referred to the table below and matched according to the actual temperature of the place of use. Due to the usage environment and the configuration of the chiller, the flow of the coolant may be affected during actual use, leading to flow alarms or laser heat dissipation problems in the chiller. For any temperature abnormality, please contact the manufacturer

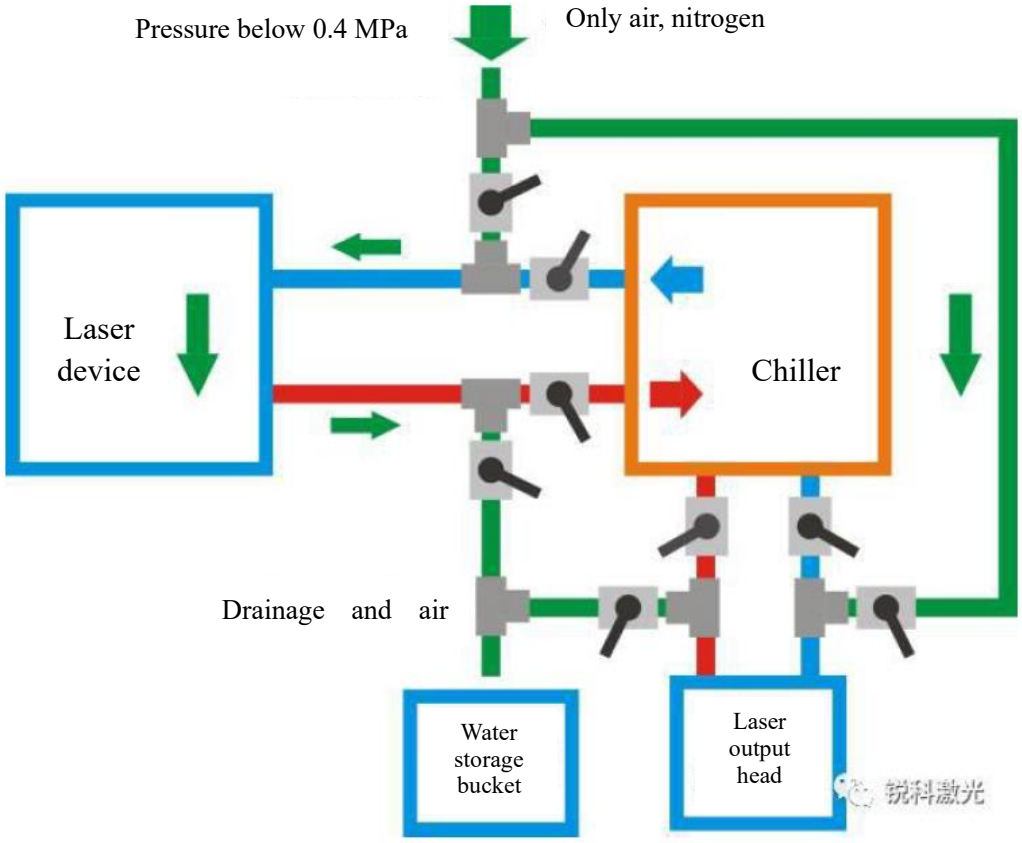
Ambient temperature ℃	Shell OAT-45℃ (Litre)	Deionized water (Litre)	Reference specific heat capacity KJ/KG.K	Special instructions
-5	0.5	1	3.757	1. The typical specific heat capacity of water is 4.2KJ/KG. K, the higher the antifreeze addition ratio, the lower the specific heat capacity of the cooling medium, and the worse the cooling effect under the same flow rate. It can be added appropriately according to the reference ratio. If conditions permit, legitimate brand antifreeze with corresponding antifreeze grade can be purchased directly. In case of flow alarm, high temperature alarm, etc., consult the chiller manufacturer; 2. The various additives that play a protective role in antifreeze products have a minimum content requirement (such as inhibiting volatilization, preventing corrosion, etc.). Dilution with water may accelerate aging, and it is recommended to replace them at least once a month.
-10	0.8	1	3.563	
-15	1	1	3.55	
-20	1.5	1	3.344	
-25	2.2	1	3.234	
-30	4.1	1	3.111	
-35	5.8	1	3.068	
-40	No water added	1	2.844	
-45	No water added	1	2.844	

2. Precautions for using antifreeze

Any antifreeze cannot completely replace deionized water and cannot be used for a long time throughout the year. After winter, it is necessary to clean the pipeline with deionized or purified water, and restore the use of deionized or purified water as a coolant. During holidays such as the Spring Festival or prolonged power outages, please drain the water from the laser device and chiller related pipelines.

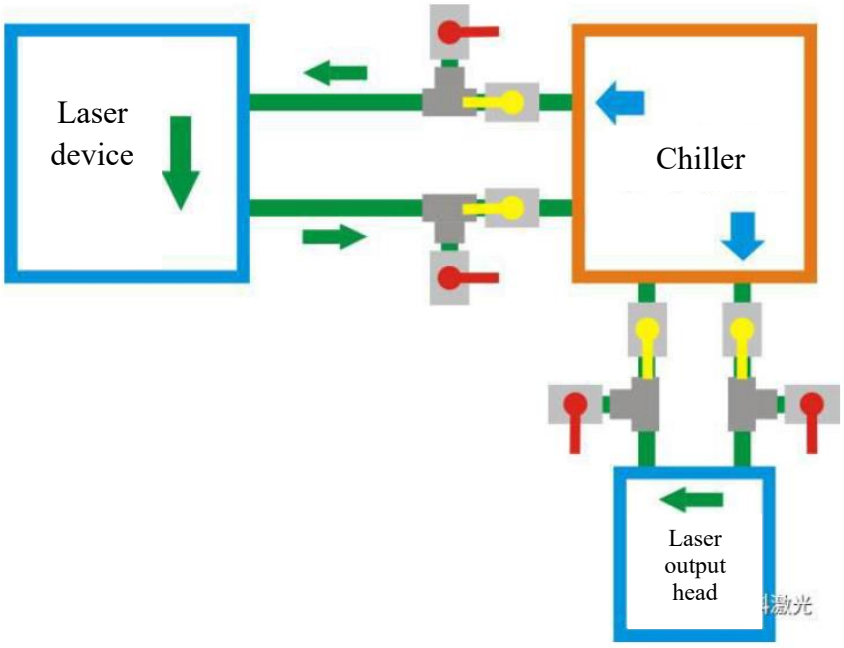
III. Coolant draining method and pipeline design reference

In extremely cold winter, it is necessary to drain all cooling water from the laser, laser output head, processing head, and chiller to effectively protect the entire water-cooling pipeline and related components.


Pressure below 0.4 MPa
Only air, nitrogen
Laser device
Chiller
Drainage and air
Water storage bucket
Laser output head
锐科激光

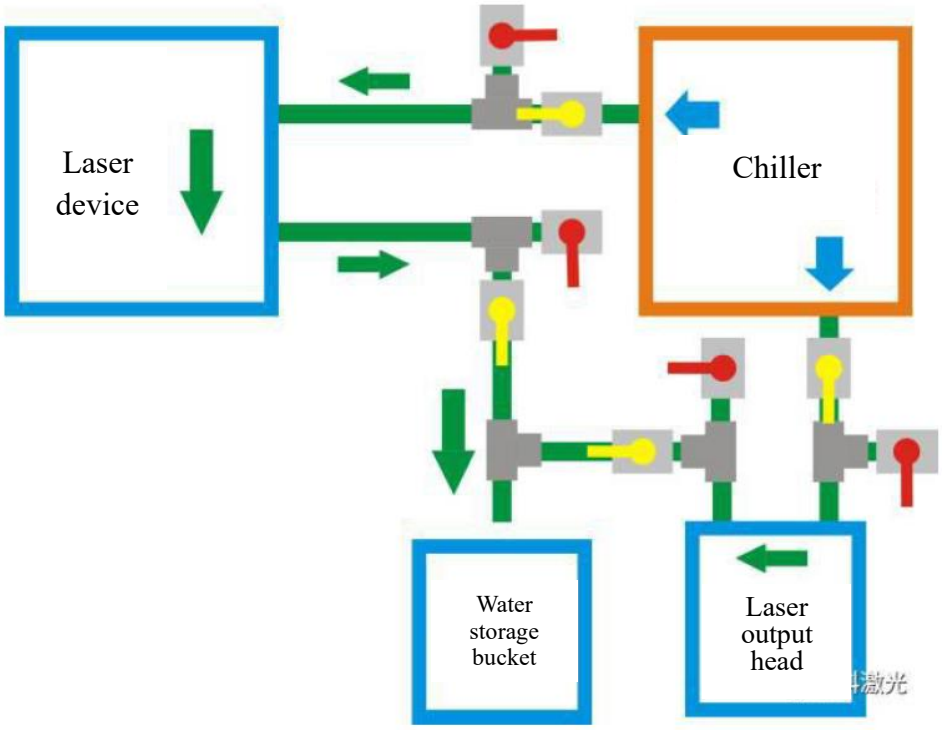
1. Schematic diagram of water pipeline connection

1、水路连接原理图



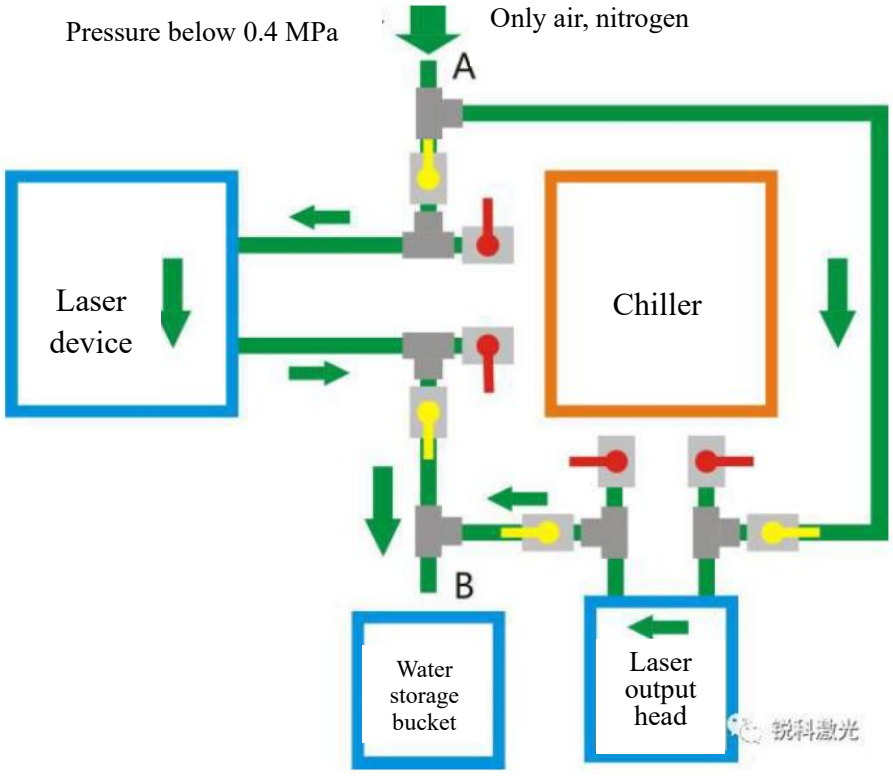
2、正常使用时的阀门状态（红关黄开）

2. Valve status during normal use (red for closing and yellow opening)



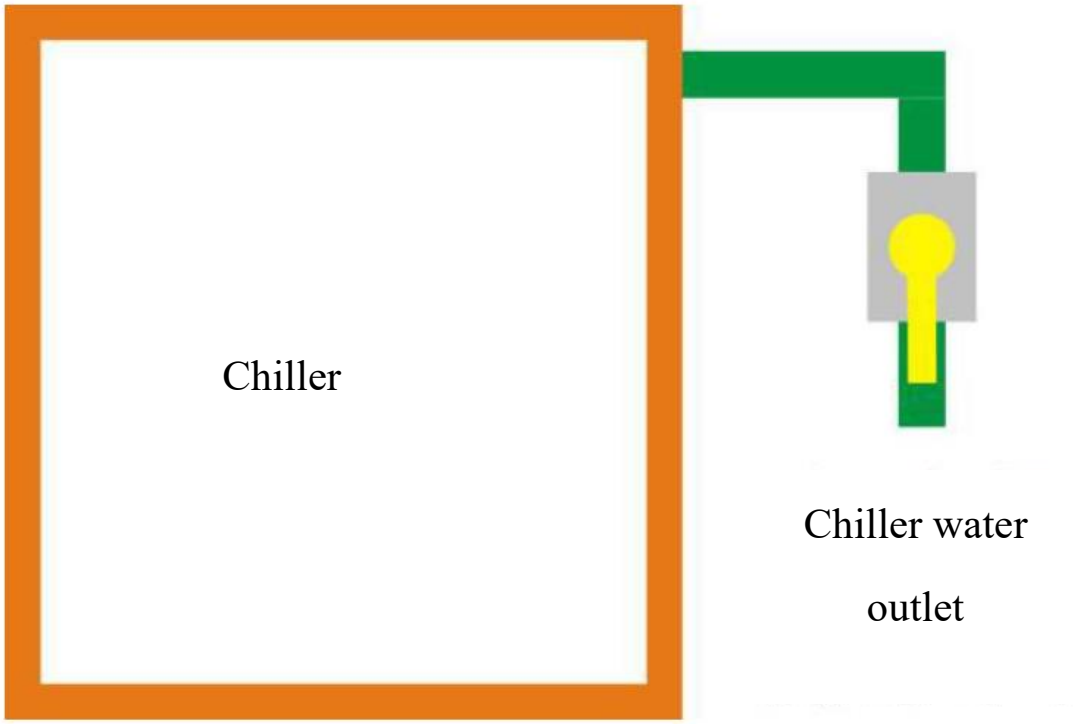
3、关机前先使用水冷机主动排空

3. Before shutting down, drain the chiller actively



4. Emptying residual water with low-pressure air

Close the red marked valve as shown in the diagram, open the yellow marked valve, and inject clean compressed air or nitrogen of no more than 0.4Mpa (within 4kg) into point A until no water droplets are blown out of the outlet at point B. Note that water droplets on the pipe wall may form ice, which may impact the fiber optic cable and crystals under the push of water flow. Please be sure to ventilate until there are no water droplets in the pipeline.



5. The chiller water outlet should be normally open

Finally, open the drain outlet of the chiller to drain the remaining water in the water tank.

IV. Special reminder

Extreme cold weather can cause irreparable damage to the optical part of the laser device. When storing and using the laser, please strictly comply with the storage and operating temperature requirements specified in the laser device manual. Make sure to stress on the prevention and protection work to prevent unnecessary economic losses.

Temperature and humidity requirements for product operating environment

Operation of the fiber laser device has high requirements for the temperature and humidity of the surrounding environment;. If the laser device is in high temperature and humidity environment for a long time, it is easy to cause serious consequences of function damage due to condensation inside the cabinet, especially that the condensation inside the laser module is easy to cause the failure or burning of important optical components.

Therefore, the customer is recommended to install the laser device in an independent air-conditioned environment to effectively ensure the temperature and humidity of operation. At the same time, adjust the water temperature setting of the laser chiller appropriately in different seasons according to the dew point temperature displayed on the laser monitoring software to ensure that the dew point temperature inside the laser cabinet is always lower than the cooling water temperature to avoid condensation. The cooling water temperature can be set according to the following table:

When the environmental temperature and humidity are determined, query the corresponding dew point temperature in the table, and then set the cooling water temperature. It is recommended to keep the cooling water temperature above the dew point temperature by more than 5℃.

Table 4 Ambient dew point under different temperature and humidity conditions

Ambient dew point																
Ambient temperature	Ambient relative humidity															
	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
16℃				0	2	4	5	7	8	9	10	11	12	13	14	15
18℃			1	3	4	6	8	9	11	12	13	14	15	16	17	18
21℃		1	3	5	7	9	11	12	13	14	16	17	18	18	19	21
27℃	2	5	8	10	12	13	16	17	18	19	21	22	23	24	25	26
29℃	4	7	10	12	14	16	18	19	21	22	23	24	26	27	28	28
32℃	7	10	12	15	17	19	21	22	23	25	26	27	28	29	31	31
35℃	9	12	15	17	19	21	23	24	26	27	29	30	31	32	33	34
38℃	11	14	17	20	22	24	26	27	29	30	31	33	34	35	36	37

Thanks for your use