



LASER WATER CHILLERS



USER'S MANUAL

DLC-M17

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Please read thoroughly before operating

Thank you for choosing our products. In order to give you a better experience in using our products and achieve the best performance, please read this manual carefully before operating.

Foreword

During the production of our chiller, we strictly follow the relevant design standards to ensure that the products provide high-quality operating conditions and stable and reliable performance for various types of terminal equipment. This manual include necessary information for proper installation, commissioning, startup and maintenance. Please read this manual thoroughly before starting and overhauling the product.

Installation and commissioning of this chiller must be carried out by trained professionals. Improper installation or commissioning or failure to follow the operating regulations in this manual will lead to equipment damage or personal injury, and is not covered by the warranty.

If you encounter any difficulties or have any questions when using this manual, please consult the manufacturer or call our service hotline (see nameplate label) for consultation.

Safety Warnings

NOTE

Installation and maintenance must be operated by technicians with professional skills. Our company will not take any responsibilities for the damages to the units or personnel injuries due to the non-compliance to this caution.

CAUTION

Sharp edges inside and outside of the unit and the surface of the coil may lead to injuries, do not touch them or do some protection work.

CAUTION

If the unit will not be operated for a long time when the ambient temperature $\leq 0\text{ }^{\circ}\text{C}$, the water in the water side heat exchanger or the water tank may freeze and cause the heat exchanger and the water tank to rupture.

WARNING

Moving the units or touching power supply may lead to injuries or death. Cut off the power supply before moving the unit.

NOTE

Power switch shall be installed at the height of at least 1.4 m (the place that cannot be reached by children), to prevent children from touching the power switch to avoid accidents.

NOTE

This unit can only be used in indoor to avoid splashing water into the unit, otherwise it will cause damage to the unit. If installed outdoor, please confirm the installation environment with the manufacturer in advance.

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This manual is only for our products which are in production. If there is any design changes , we will not inform you in advance.

1.Product Introduction

1.1 Application Range

The laser water chiller is a supporting cooling system specially for laser equipment (please refer to the attached "Schematic Diagram of Refrigeration" for the principle). It is suitable for laser processing equipment with optical fiber and semiconductor as laser working medium, including laser equipments like laser welding, laser marking, laser cutting, laser cladding, laser drilling, laser cleaning, laser movie. All models are equipped with LCD temperature control display and intelligent adjustable cooling system, which greatly improves the temperature stability and help the laser output more stable.

1.2 Product Features

- ◆ Ingenious design, compact structure, easy to install and operate;
- ◆ The refrigeration system equipped with internationally renowned brand components, with excellent quality and performance, and automatic constant temperature function. The stability could be ± 0.1 , ± 0.2 , $\pm 0.3 \sim \pm 1.0^{\circ}\text{C}$ optionally.
- ◆ The water circulating system equipped with industrial anti-rust water pump, stainless steel water tank, PVC pipes and connection fittings, no worry of corrosion.
- ◆ Equipped with flow protection, when there is no water in the pipeline or less flow, can automatically cut off the control loop, make the chiller stop running, and output alarm signal;
- ◆ With high and low temperature protection, output with normal closed alarm signal;
- ◆ With anti-freezing protection: some models have anti-freezing function in winter, which can effectively prevent water system from freezing in standby status.
- ◆ Electronic temperature controller developed independently, with intelligent control, a variety of settings and fault display functions, simple operation;

1.3 Working Conditions

Environmental requirements:

- ✓ Ambient temperature: $5 \sim 40^{\circ}\text{C}$
- ✓ Related humidity: $\leq 90\% \text{RH}$
- ✓ Altitude: $\leq 3000\text{m}$

Coolant required:

- ✓ Softened water (Purified water, Distilled water, Deionized water, etc.)
- ✓ Glycol antifreeze solution which is allowed by laser supplier
- ✓ Preservative or algicide approved by laser manufacturer

Coolant prohibited:

- ✗ Motor vehicle antifreeze, volume ratio >30% of antifreeze
- ✗ Flammable liquids such as acetone
- ✗ Oil and oil-based liquids
- ✗ Medicine, food liquid
- ✗ Liquid with PH value exceeds 6.5~7.5
- ✗ Liquid containing solid particles
- ✗ Other corrosive liquids to copper and stainless steel

1.4 Type Code Explanation

D IC 010 A S H - L A 2 - A AA - C ** - PW
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭

- ①D : Code for Doluyo brand
- ②IC: Water chiller
- ③Code for cooling Capacity: 004, 006, 010.....
- ④Cooling type: A: Air cooled W: Water cooled
- ⑤Chiller features: D : Dual temperatures and Dual controls H: High precision dual temp. & dual controls S: Single temp B:Single temp high precision
- ⑥Pump features: L:Low lift pump H:High lift pump S:Super high lift pump N:No pump
- ⑦Structure and application: L : Water chillers for laser machines I: Water chillers for other industrial applications
- ⑧Product generation: A:First generation B:Second generation C:Third generation.....
- ⑨Code for refrigerant:1:R134a 2:R22 3:R404A 4:R407C 5:R410A 6:R507C
- ⑩Power supply: A:1Ph-220V@50Hz F:3Ph-380V@50Hz G:3Ph-380V@60Hz K:1Ph-208~230V@60Hz N:1Ph-115V@60Hz P: 3Ph-208~230V@60Hz
- ⑪Description of the changes in products
- ⑫Sales area: C:Chinese domestic market O:Overseas market
- ⑬Code for customized: 01,02,03.....
- ⑭Special application: PW: Hand-held laser welding machine

2. Unit installation and inspection

The installation of the unit must be completed by a trained technician and must comply with the requirements of the national and local government regulations, standards and product installation instructions on electrical, construction and environmental protection. When installing, ensure the following conditions:

2.1 Preparation before installation

a) Inspection

- ◆ All chiller are packed and shipped in carton or wooden case. The refrigerant has been precharged in each unit. The user does not need to fill again.
- ◆ The user shall check the unit carefully when receiving it, to make sure that the unit is not damaged in the process of transportation and if any accessory is missing.
- ◆ We will not be liable for any damage to the goods occurred in the process of transportation and the goods are normally signed and received.

b) Carrying

During carrying, the unit shall be kept level to avoid damage to the machine due to improper operation, and appropriate protective measures shall be used to protect the appearance of themachine. Please see figure 1 as below.

c) Unpacking

Put unit in the position of required, cut off the packing belt, remove the pallet and packing case, and make the unit flat.

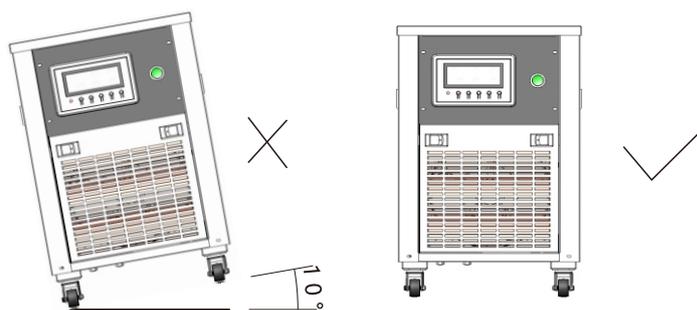


Figure 1 Handling requirements: angle of inclination $<10^\circ$

⚠ CAUTION:

- ◆ The chiller must be handled with great care. Do not put it upside down.
- ◆ If the product is attached with a packaging strap, do not use this strap to lift or carry the product, the strap is easy to break will cause accidents or danger.
- ◆ Do not touch the heat exchanger fin with bare hands. They may cut your finger.

2.2 Installation Location Selection

a) In order to obtain the best cooling performance, the installation location of the chiller should be selected according to the following points:

- ◆ The installation position should be such that the hot air exhausted by the machine is not sucked back into the machine, and won't suck the hot air exhausted by other machines, and sufficient space should be reserved for maintenance.
- ◆ There should be no obstacle to block the airflow on the air exhausting or suction side of the chiller.
- ◆ The installation position of the machine should be well ventilated to achieve better heat exchanging.
- ◆ The installation position should be strong enough to bear the weight of the machine and the vibration during operation.
- ◆ Avoid installing in the dirty, oily, salty, or there is a lot of sulfide gas places.
- ◆ Do not install chiller at where flammable gas may leak out. If flammable gas leaks and accumulates around the unit, an explosion may occur.
- ◆ Do not install the chiller in a place susceptible to strong wind or typhoon. If possible, it can be equipped with rain-proof, snow defence, direct sunlight protection and other auxiliary equipment.

b) Spaces requirement around chiller, see Figure 2 & Figure 3.

Chiller can be installed separately in a certain place, or multiple chillers be installed in a larger site. If more than one chiller is installed in one place, pay attention to their arrangement.

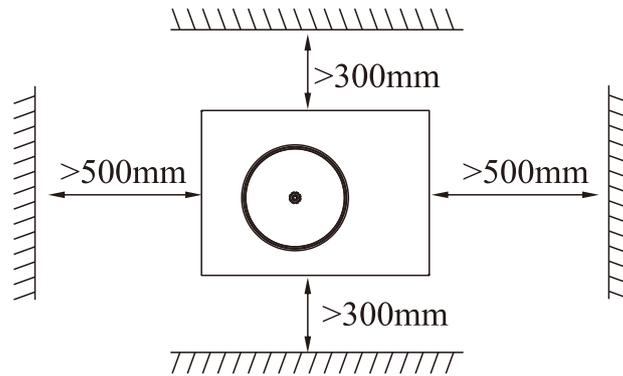


Figure 2 Installation requirements for side exhaust chillers

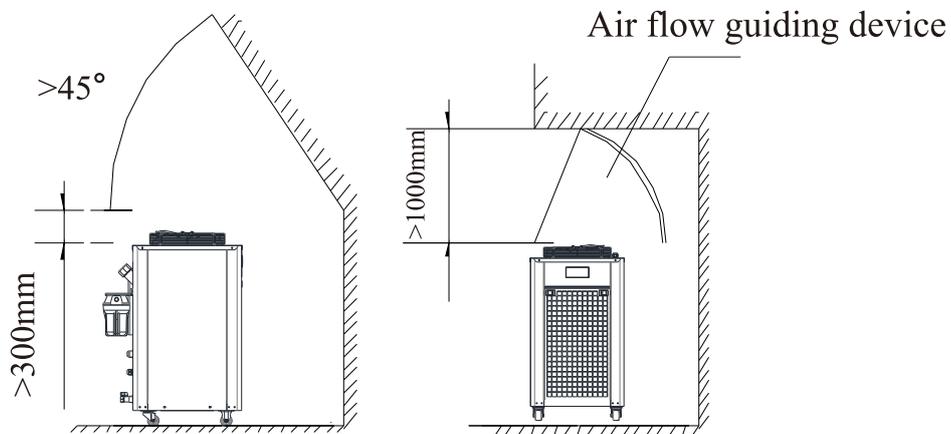


Figure 3 Installation requirements for top exhaust chillers

c) Rack-mounted chiller should have vent holes on all sides

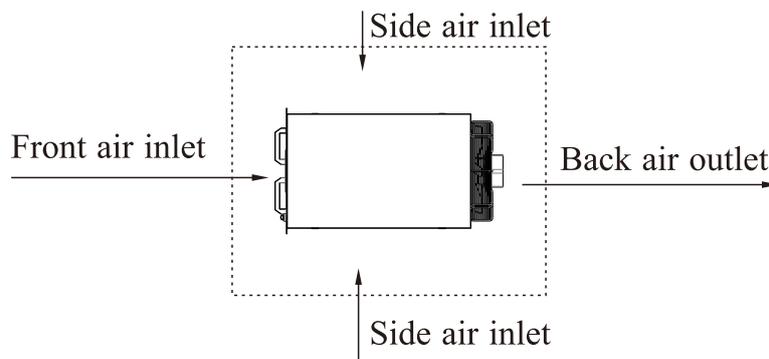


Figure 4 Rack-mounted chillers ventilation requirement

2.3 Electrical Connection

Before connecting the circuit, the following safety rules and measures must be strictly observed:

- ◆ When the machine is installed, the electrical parts should be installed by professionals, users are not allowed to remove and add control parts. We are not responsible for any machine damage or casualties caused by any non-compliance with the safety rules.
- ◆ Please refer to "Electrical connection diagram" for circuit connection.
- ◆ Machine ground wire should be well grounded. The ground line must not be connected to the gas pipe, water pipe, telephone line, poor grounding will lead to electrical shock accident.
- ◆ Check if the power supply on the main line meets the requirements before starting up.

2.3.1 Line diameter selection

- a) Please refer to the wiring label on the chiller when wiring.
- b) Recommended standard for selection of power line diameter.

Line Dia. mm ²	0.75	1	1.5	2.5	4	6	10	16	25	35	50
Current(A)	8.5	10	13.5	18	25	36	50	65	85	105	125

- ◆ The above data is in accordance with standard of IEC 60204-1: Ambient temp. 40°C B1 laying method, it's for reference only.
- ◆ The power cable must use standard cable.
- ◆ See the nameplate of chiller for rated current.
- c) Suitable leakage and overload protection devices must be installed in the main circuit of the main power supply, and ensure that the machine is well grounded.
- d) The power supply voltage is allowed to fluctuate less than $\pm 10\%$, the frequency fluctuation is less than $\pm 1\text{Hz}$, and away from electromagnetic interference sources.

2.3.2 Electrical connection diagram

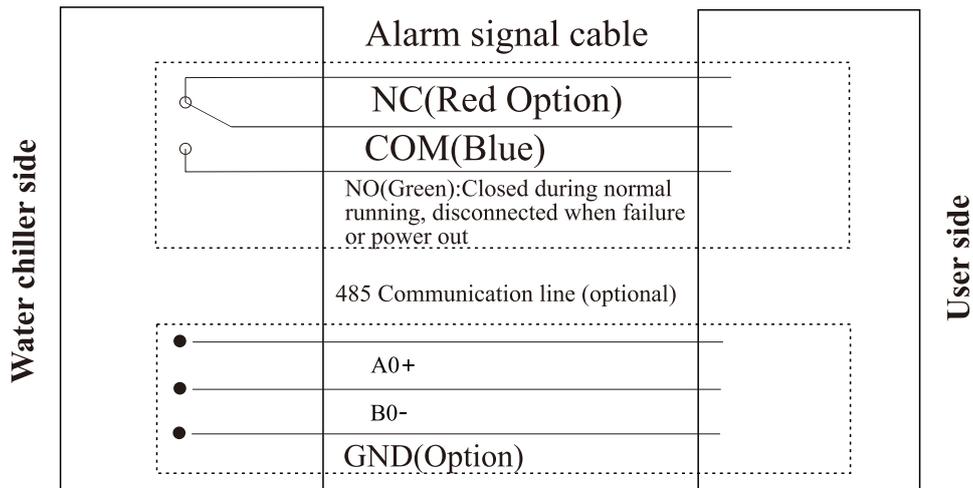


Figure 5 Signal Line Connections

⚠ CAUTION: the 485 communication line is not allowed to connect to the active signal, otherwise the controller will be damaged.

Signal cables are connected with DB9 in some models. See Appendix 6 for details.

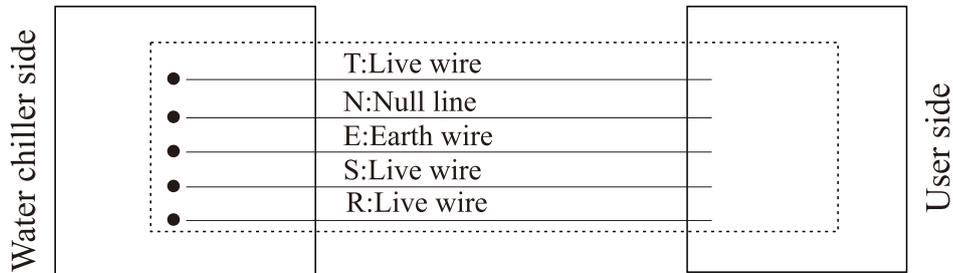


Figure 6 Connection of 380V power cable

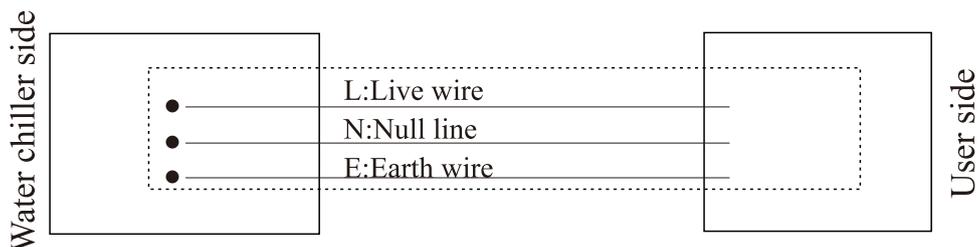


Figure 7 Connection of 220V power cable

2.4 Water Pipe Connection

Connect the water pipe to the inlet and outlet on the unit.

Water supply systems should note the following:

- a) Water flow should not be below the nominal value of the unit
- b) The water pipe must be insulated to prevent heat loss and condensation water occurs.
- c) Please refer to " Installation Diagram of Water System" for water system installation.
- d) Please install the water filter attached to the unit in the outlet port and clean the filter after commissioning.
- e) Before filling water, make sure there is no sands, gravel, rusted iron, loose welding slag or other impurities in the pipeline to avoid damage to the heat exchanger. When flushing the water supply system, bypass the water cycle is suggested.
- f) For the water circulating system, inspect it every half a month is required.

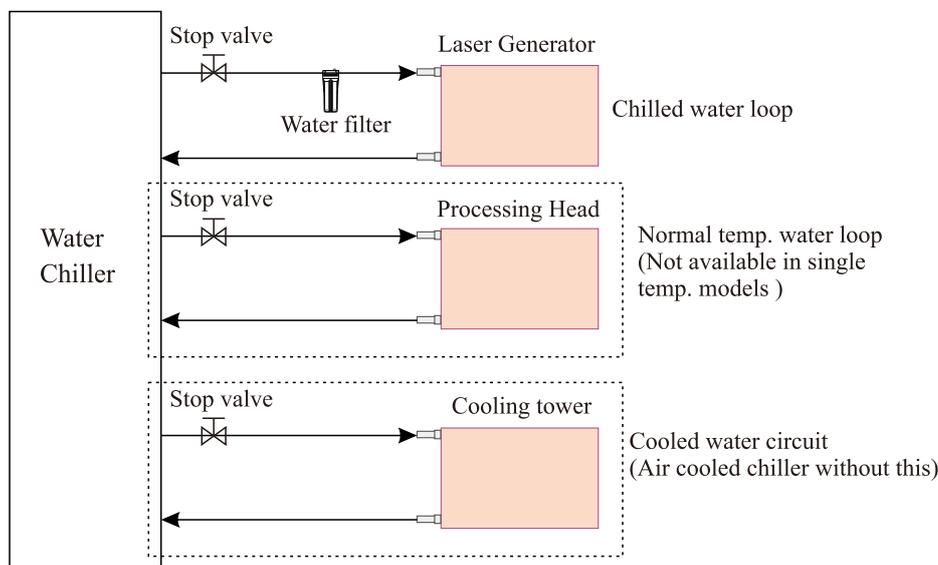


Figure 8 Installation Diagram of Water System

Note :

- a) Water port location, accessories and size are different in different models, Water Pipe Connection Diagram is for reference only, please refer to the actual unit.
- b) In case of any customized requirements, the technical parameters and drawings please refer to the one in appendix.
- c) Avoid splashing water into the electrical part of the unit or inside the unit when refilling water, otherwise it will cause damage to the unit.
- d) To avoid liquid leakage, be careful when selecting hoses and connections. When the chiller is more than 2m away from the laser equipment, it is necessary to increase the diameter of the connection hose, otherwise the pipe resistance will affect the water flow. If the ambient temperature and humidity is high, we suggest you to make the pipes with insulation.

2.5 First Start-up Inspection

- a) Ensure that the power supply voltage is same as required by the product nameplate (voltage fluctuation shall not exceed $\pm 10\%$)
- b) Check if the wire diameter, wiring is correct, ground wire is firmly connected. Check that the water flow switch, pump, etc. is properly connected.
- c) Water pipes and hose must be flushed at least two or three times to ensure cleanliness without any pollutants.
- d) Check if water volume is enough and there is no leakage.

2.6 Start-up

- a) After plugging in the power cable, the control panel of the water chiller starts normally and all parameters are displayed normally.
- b) Ensure the normal operation of the chilled water before the starts up. After the new machine starts up, the air in the water pipe should be drained¹. The water level of the water tank will drop slightly².
- c) After the pump starts, the power indicator light is on.
- d) The compressor starts (the first startup will be delayed for 3 minutes after each power failure), the operation indicator light is on, and the machine works normally.

⚠ Note: Do not start the pump without water, otherwise the pump will be damaged.

2.7 Running status Inspection

After the unit runs smoothly, check the following :

- a) Water temperature in water tank.
- b) If the water flow is normal, if there is water leakage or blockage.
- c) System pressure

The above data can help to judge if the machine is running normally.

Note 1: Selection of Air Evacuation Method

【Method 1】 Evacuate the air through the exhaust valve (see Figure 11):

Press the exhaust valve down to the right position and hold it for about 10 seconds, then release it. Press it again after 5 seconds, repeat this process 5 times or more.

【Method 2】 Tap the pump to evacuate the air: Press the power button on the control panel to startup and run it for about 10 seconds, then press the power button to stop it. After about 5 seconds, press the power button again, and repeat this process 5 times or more.

Note 2: Water Adding Method

◆Preparation: Choose the appropriate container according to the tank volume on the nameplate, which is recommended to be 10-20% larger than the tank volume;

◆Before adding water: Unscrew the cap of the water refill port;

◆When adding water:

- a) Align the water outlet of the water storage container with the refill port.
- b)Observe the liquid level indicator and fill the liquid level between the Max. and Min. level marks.

◆After adding water:

- a) Evacuate the air according to the method described in Note 1.
- b) Tighten the water refill cap.

⚠ To avoid water overflow, pay attention to the following points when adding water:

◆Do not open the water tank cover inside the chiller to add water directly, to prevent water from splashing into the chiller and causing damage.

◆The recommended water filling speed is <50 ml/s. Adding water too quickly can cause a large number of small bubbles in the water tank due to the high impact force. This hinders the water pump from pumping smoothly and may even prevent it from pumping water at all, thus increasing the evacuation time. After the liquid level exceeds the minimum level, it is necessary to reduce the water filling speed to minimize the risk of overflow.

◆Do not add water beyond the maximum water level;

◆Do not move the chiller after adding water. If you need to move it, lower the water level to below the minimum water level through the drain outlet. The speed required when moving is <0.2m/s. Do not pass through road sections with large inclination angles (greater than 10°).

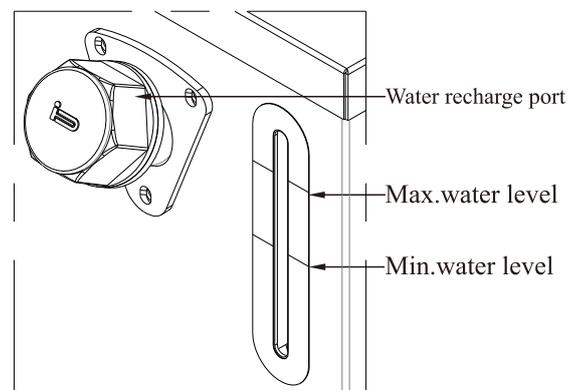


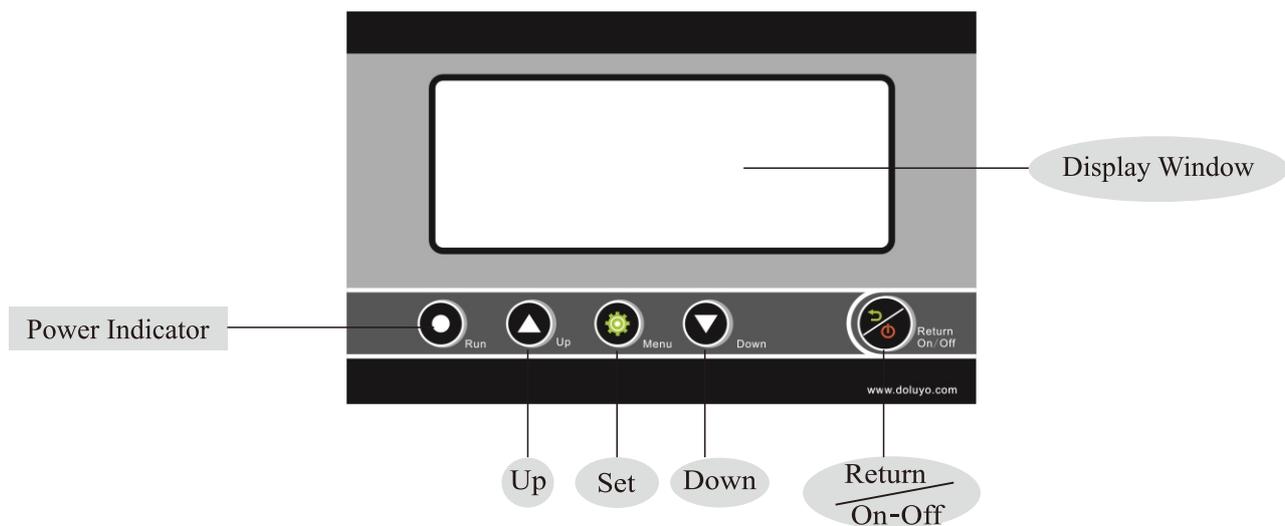
Figure 9 Safe liquid level should be between Max. and Min. water level

3 .Operation

Different models have different controller(Controller A & Controller B), they have different operation steps or control logic.

3.1 Controller A

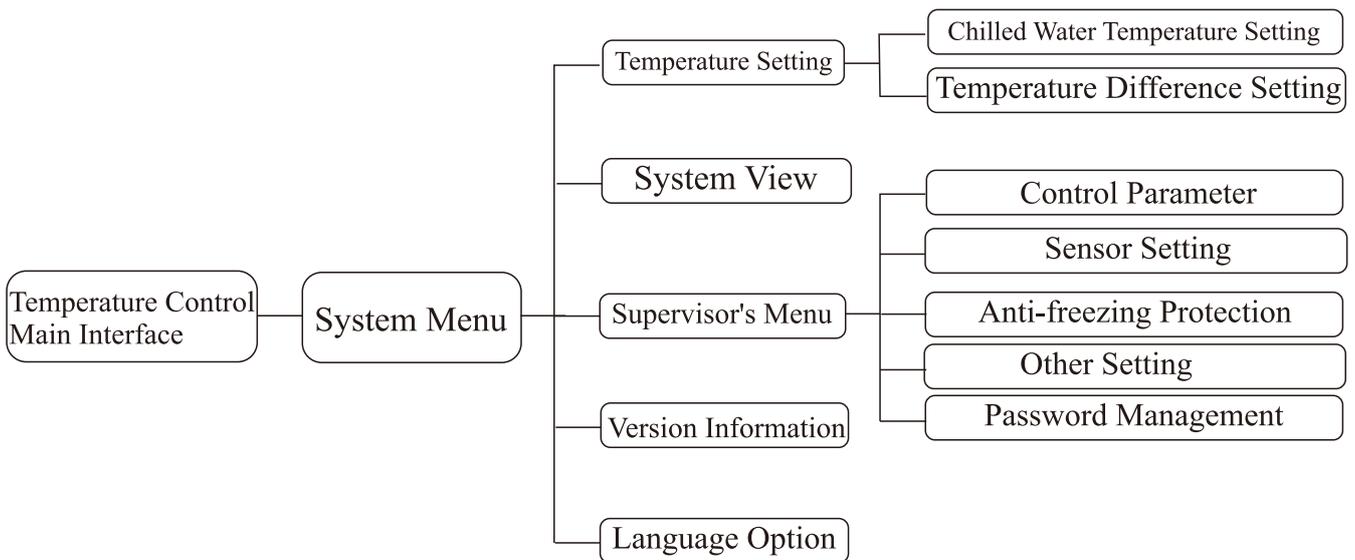
3.1.1 Control Panel



- ① Up key (Press once to increase once, long press to increase continuously)
- ② Enter the Menu or switch settings
- ③ Down key (press once to decrease down once, long press to decrease continuously)
- ④ Power Switch / Return Save

- ① In all setting interfaces, if there is no key action for 10 seconds, it will automatically exit the setting interface and save the parameters when exiting.
- ② If you need to debug during the alarm, you can press the switch to close all outputs.
- ③ In any setting menu, press "Return / On-Off" key  to save the data and return to the running interface.
- ④ Shutdown: Press and hold the "Return / On-Off" key  in any state for 3 seconds to stop system operation.

3.1.2 Temperature control display brief interface

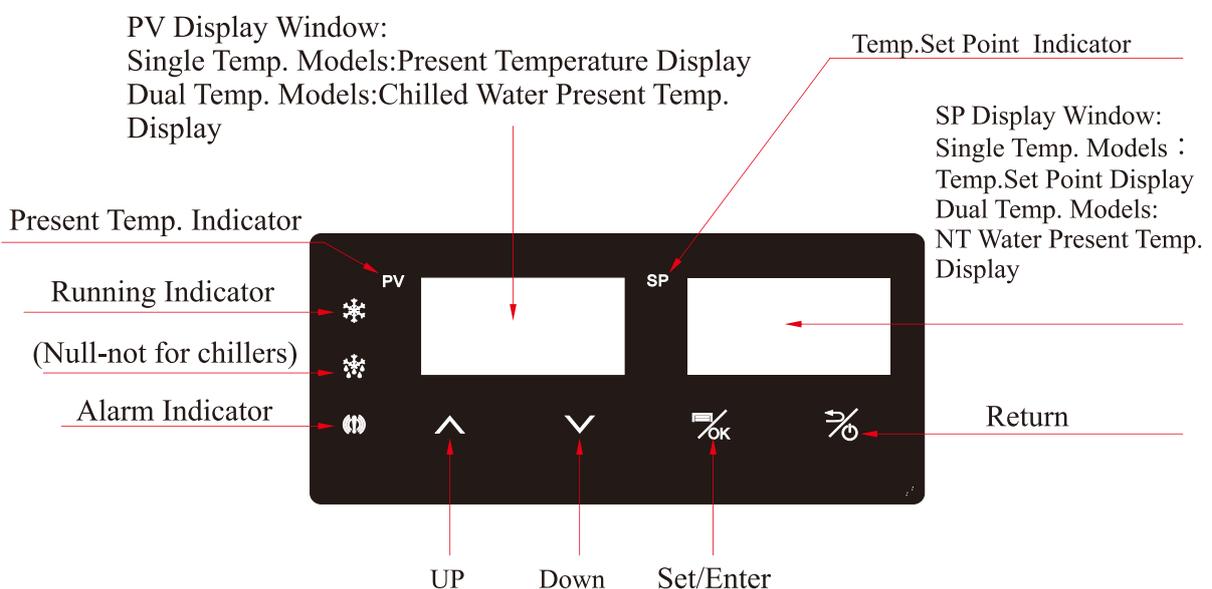


3.1.3 Machine operation mode

After the machine is turned on, the water pump starts to work after 5 seconds, and the system performs intelligent detection. If the chilled water temperature > set temperature, the compressor and fan run after 5 seconds, the system starts to cool; if the chilled water temperature < set temperature + temperature difference, turn on the electric heater, when the water temperature reaches the set point, turn off the electric heater, the compressor and fan start up, the system begins to cool, and the system enters normal operation. (Note: The water temperature will fluctuate for a few cycles just after entering the regulation, which is normal).

3.2 Controller B

3.2.1 Control Panel



3.2.1.1 Keys Description

Up Key

- a) When parameter setting, short press the up key to increase the setting value by 1 or 0.1, long press to increase the setting value rapidly and continuously.
- b) when normal operation, long press the up key to display the real time ambient temperature in SP display (only for ambient temperature interlock units) . Press any key to exit or automatically exit after 5 seconds of no operation.

Down Key

When parameters setting, short press the down key to decrease the setting value by 1 or 0.1, long press to decrease rapidly and continuously.

Set/Enter

- a) When the unit in normal operation, short press the Set key to quickly enter temperature setting, long press to enter the user parameter setting, and long press for 40 seconds to lock/unlock.
- b) When setting parameter, press Enter to save the current setting; If no operation for 10 seconds it will automatically save and return to the home page.

Retrun

- a) When setting parameters, short press the return key to exit (press enter key to save and exit if you do not press enter, just exit without saving).
- b) When alarming, long press to shut down and clear alarming.

Key combination

- a) When the unit in normal operation, long press the SET key + UP key to display t00, then press the UP key to adjust to t03 to display the current water flow (this value would not automatically refreshed, you can view the updated flow by pressing the UP or DOWN key).

3.2.1.2 Temp. Setting Description

◆ **Single Temp. Models Setting:**

When normal operating, short press the setting key, the SP (setting temperature display window) flashes, press Up and Down keys to adjust the target temperature. Short press Ok key to save the setting. No operation within 10 seconds it will automatically save and return to the home page.

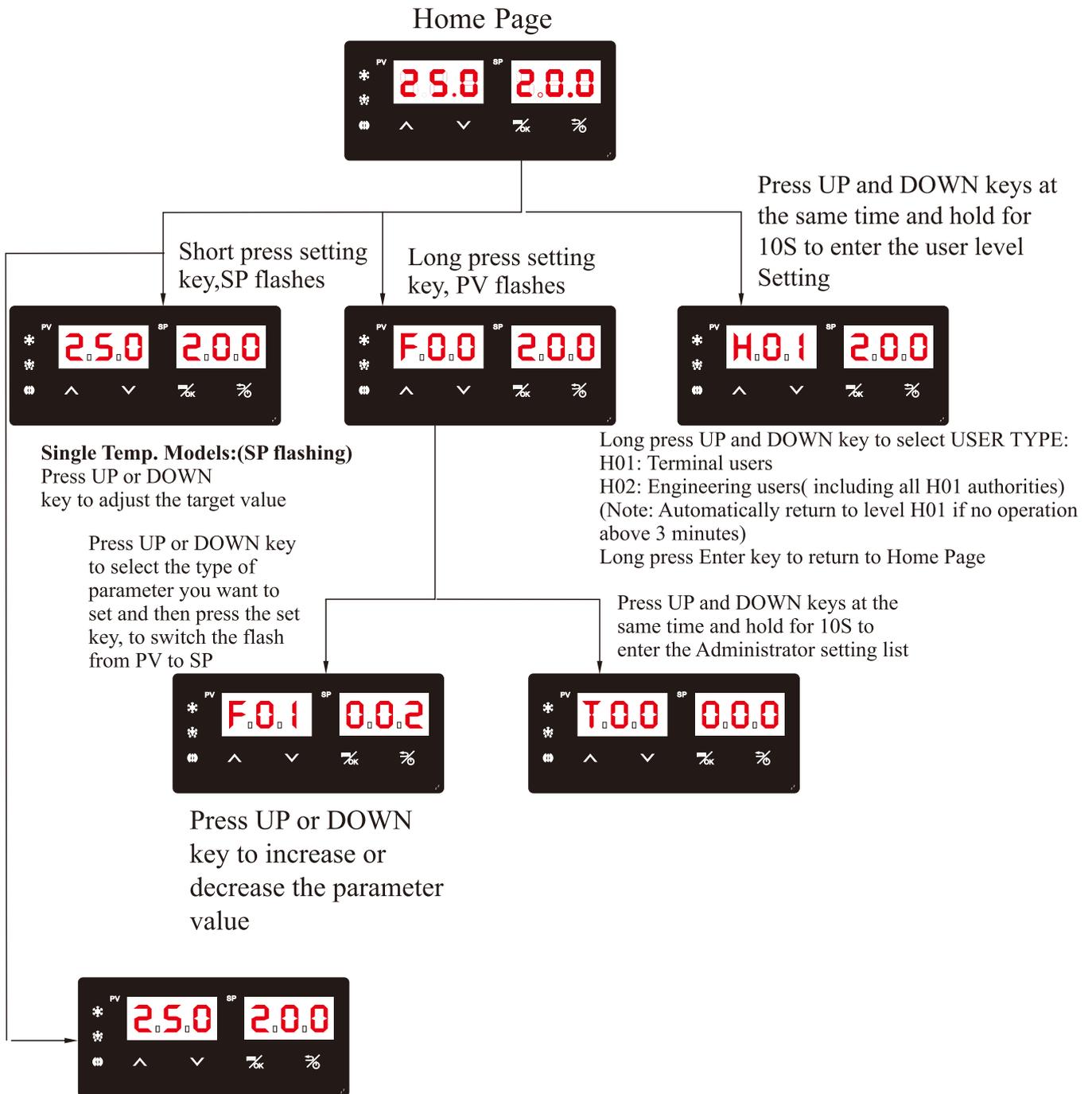
◆ **Dual Temp. Models Setting:**

When normal operating, short press the setting key, the PV (chilled water temperature display window) flashes, press Up and Down keys to adjust the target temperature of the chilled water, short press the OK key to save the settings and switch to the SP Display Window flashing (Normal temperature water temperature), press Up and Down keys to adjust the target temperature of the NT water, short press OK key to save the setting, if not operated within 10 seconds, it will automatically save and return to the home page.

Note:

- 1) Cooling indicator: Off when in standby status. On when starting up (compressor running).
Flashes when in delayed status (including startup delay and shutdown delay).
- 2) Alarm Indicator: lights up when alarming.
- 3) Short press: less than 2 seconds. Long press: more than 2 seconds.

3.2.2 Operation Flow Chart



Dual Temp. Models:

PV(Chilled water temperature display) flashing, press up or down to adjust target value, shot press OK to confirm and save the settings and switch to SP display (NT water temperature) flashing, press up or down to adjust target value, shot press OK to confirm and save the settings.

3.2.3 User Parameter Setting Table

Code	Item	Range	Default	Unit	Remark	User Type
F00	Temp. Setting	Adjustable: Min:F09-Max:F08		°C	Press SET to set	H01
F01	Control Precision	0.1, 10		°C		
F05	high temp.alarm value	10, 60		°C		H02
F06	low temp.alarm value	-10, 20		°C		
F07	High low temp. alarm delay	0, 5		min.		
F08	Temp.setting Max.value	20,100		°C	In Amb.Temp interlock mode, when Amb.T higher Max value, use Max.temp.	
F09	Temp.setting Min.value	-20, 40	5	°C	In Amb. Temp interlock mode, when Amb.T lower than Min value, use Min.temp.	
F12	Operation Level	0, 3	0	--	0'Current parameters; 1'Restore Defaults; 2'Save all current parameter as factory default setting; 3'Restore factory default settings.	
F13	Pump delay when start-up	0, 10	0	Sec.		
F14	Pump delay when shut down	0, 10	0	Sec.		
F34	Temp.diff. amb.Temp. interlock	-10, 10	5	°C		
F35	Signal output start mode	0, 1	0	--	0'Begin output when there's flow signal; 1'Begin output when in constant temp.status and there's flow signal;	
F36	Constant temp. output temp. diff.	0, 20	5	°C	Target water temp. diff. range, when constant temp. output mode.	
F41	Temp for anti-freezing heater disable	0, 1	0	--	0'Temp.setting mode; 1'Ambient Temp. interlock mode;	
F43	Temperature difference for electric heating start	0, 50	5	°C	Temperature difference for chilled water electric heating start	

Note:

Some professional parameters can only be operated by related permission with password; For the above parameters, the user only need to set F00 and F01, and no need to change other settings.

3.2.4 Error Code Explanation

Alarm Code	Fault	Normal	Abnormal	Output status when normal and abnormal		
				Comp.	Water Pump	AlarmRelay
E01	Water temp. sensor abnormal	Normal resistance	Open circuit or short circuit	1/0	1/1	1/0
E02	High temp.alarm	T<TH set	T>TH set	1/1	1/1	1/0
E03	Sys. pressure abnormal	NC	NO	1/0	1/1	1/0
E05	Water flow abnormal	NC	NO	1/0	1/1	1/0
E06	Liquid level alarm	NC	NO	1/0	1/1	1/0
	External cooled water flow alarm(not available for air cooled chillers)	NC	NO	1/0	1/1	1/0
E08	Low temp. Alarm	T>TL set	T<TL set	1/0	1/1	1/0
E09	Amb. temp. sensor	Normal resistance	Open circuit or short circuit	1/0	1/1	1/0
E10	Water temp. sensor Pt1000 fault	Normal resistance	Open circuit or short circuit	1/0	1/1	1/0
E14	Reminder for changing wate	Normal	buzzer alarming	1/1	1/1	1/1

4.Trouble Shooting



Warning: Maintenance should be carried out by personnel with professional skills. When the power is connected, dangerous voltage will be present in the chassis part. Take great care when measuring live voltage.

4.1 Machine not running (no cooling or pump not working)

- ◆ Check if the power cable is connected to the power plug.
- ◆ Check if the power switch is on.
- ◆ Check if the control panel power is on.

4.2 The pump doesn't work properly

- ◆ Check the liquid level throughout the system to ensure that the pump is pumping properly.
- ◆ Check whether the pump motor is running.
- ◆ Check circulation loop for blockage.

4.3 Insufficient pump pumping

- ◆ Check if the voltage is too low.
- ◆ Check if tube diameter is too small.
- ◆ Check if the pipe connection is restricted.

4.4 No cooling or bad cooling performance

- ◆ Check if the voltage is too low or too high.
- ◆ Check if the ventilation is block.
- ◆ Check ambient temperature, too high ambient temperature will cause refrigeration compressor short-time shutdown.
- ◆ Check if the condenser fins are dirty or the air filter gauze is not cleaned.
- ◆ If the temperature of the installation environment is too high to cause poor heat dissipation.
- ◆ There may be some refrigerant leakage in the system (pressure alarm will not occur at this time).
- ◆ Replacing compressor can help to improve the cooling performance when the unit exceeds normal service life.

4.5 Temperature is not stable, far beyond the temperature difference setting, always cooling or always heating. Check if the power supply voltage is too low (the normal voltage is between $\pm 10\%$), low voltage may cause refrigeration solenoid valve and bypass solenoid valve can not converts normally.

4.6 No water flow or low water flow:

Check if the air inside the pump has been release thoroughly, or the water cycle is blocked or bent, flow switch or flow meter is damaged.

4.7 Water temperature alarm:

Check if the alarm value of water temperature is set reasonably. Too high for the low temperature alarm or too low for the high temperature alarm would easily cause over-temperature alarms. The default low temperature alarm setting is 5°C, and high temperature alarm is 40°C.

5 Maintenance

Equipment maintenance must stop first, cut off the power, start to handle after 5 minutes, otherwise there will be a risk of electric shock. When the ambient temperature is below 0°C the internal water must be drained when the machine is shut down for a long time.

5.1 Weekly inspection

Weekly inspection is the main content of daily maintenance of the machine. The daily maintenance should analyze whether the equipment has safety hidden trouble in the running state, vibration, noise, running data and so on, and find out the problem in advance. Mainly includes the following:

- ◆ Check the dust gauze and clean the dust and foreign matters on it (see figure 10).
- ◆ Check the liquid level of water tank and replenish water in time when low level.
- ◆ Dust removal and decontamination on the outside of the equipment.

5.2 Monthly inspection

Generally in the monthly inspection we need to add the following content:

- ◆ Check the circulation pump noise and the water pipe connections. Contact the manufacturer if there is any abnormal noise or water leakage.
- ◆ Check the operation of fan and compressor, contact the manufacturer for abnormal noise.
- ◆ Check the water filter, if there is any foreign matter, please clean it or replace the filter element in time (see Figure 11).
- ◆ Please clean the water tank, electric heater, rinse the filter element and replace the water once a month to ensure the clean water loop.

5.3 Inspection every 3 months

Generally, the following contents should be added to the three-month inspection:

- ◆ Replace the softened water in the water system.
- ◆ Check and clean the tank to ensure good cooling performance.

5.4 Semi-annual inspection

Generally, the maintenance is carried out when the system is out of service. For the issues that cannot be solved in daily operation when producing, the maintenance need to be carried out during the semi-annual inspection.

- ◆ Check and clean the condenser.
- ◆ Check the connection of pipes and water pump to see if any leakage.
- ◆ Dust removal and decontamination inside and outside of the equipment.
- ◆ Check the water tank and clean up the dirt inside it.
- ◆ Replace the softened water in the water system.
- ◆ Test insulation resistance, it should be $\geq 5\text{M}\Omega$.
- ◆ Check grounding resistance, it should be $\leq 4\Omega$.
- ◆ Test the capacitance value of the capacitors used in motors. Capacitors need to be replaced when capacitance value attenuation over 10%.

5.5 Pay attention to antifreeze in winter

When the water temperature is lower than 0° in winter, the water system will freeze. In order to prevent freezing cracks in the pipes and damage to the equipment, antifreeze solution can be added to the water system if possible (When ethylene glycol is used as antifreeze, it should be noted that its freezing point changes with its concentration in the aqueous solution. The volume ratio is recommended to be less than 30%, see details in Appendix 3).

5.6 Prevent condensation in summer

In summer, when the temperature difference between ambient and water temperature is large, the water vapor will dew on the pipe, then damaging the heat source equipment components. Therefore, the temperature setting point of the chiller in summer is not the lower the better. In order to ensure the normal operation of the equipment, the circulating water temperature can be set according to the table in Appendix 4.

5.7 Liquid level

The machine should be checked regularly to see if need to add liquid. Usually the water in the water tank should cover the coil, when lower than the coil then it need to add liquid. If there is air bubble in the transparent hose or there are air bubbles at the water inlet of the tank, check is there is air leakage in the water inlet or if the liquid level is too low.

5.8 Refrigerant refill

Each machine is supplied with sufficient refrigerant when it leaves the factory. It's no need to replenish refrigerant during normal operation, and it is not allowed to fill or replace refrigerant. If you need to be replenished due to leakage, please refer to the charging volume specified on nameplate.

ATTENTION: If the refrigerant is refilled, the system needs to be thoroughly vacuumed again.

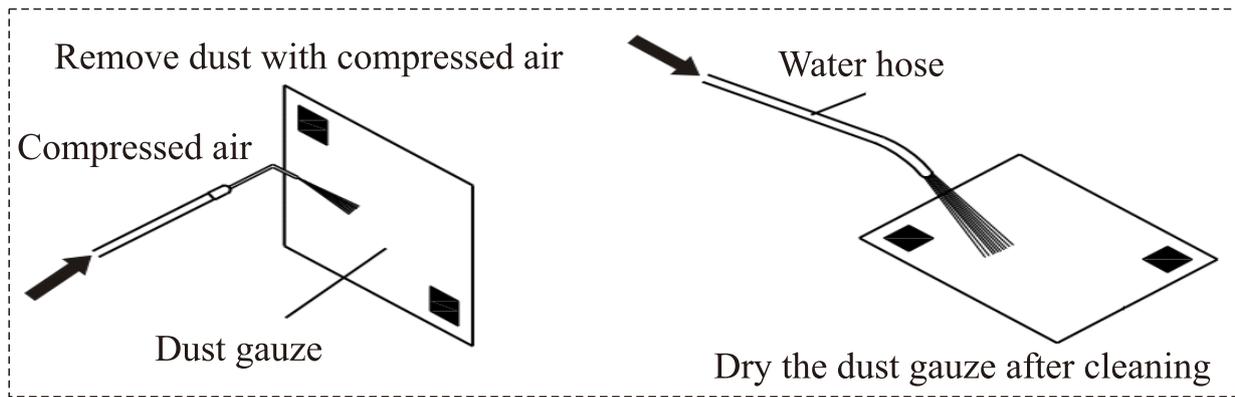


Figure 10 Clean and dry the dust gauze

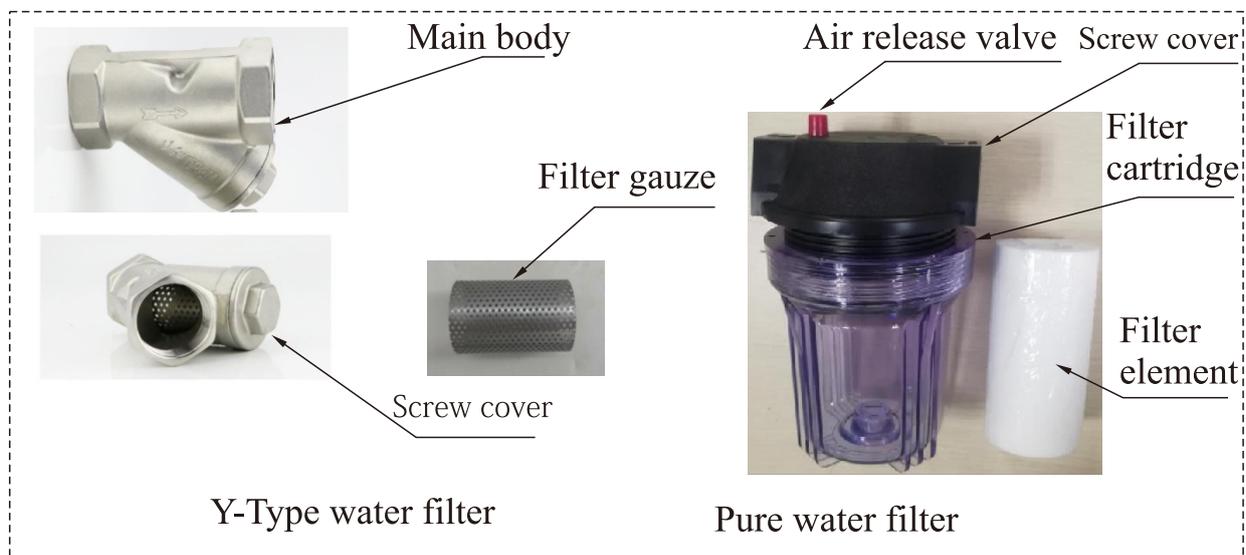


Figure 11 Commonly used 2 kinds of filters

6.After-sales Service and Warranty

6.1 After-sales Service

Repair the unit should be manufacturers or professional laser equipment service providers, maintenance or improper repair may lead to water leakage, electric shock or fire. When the unit must be moved and reinstalled, please ask the manufacturer or professional technician to do it. Improper installation may lead to water leakage, electric shock or fire.

The following details should be provided when requesting repairs:

- ◆ Complete model, see details on nameplate label.
- ◆ Serial number, see details on nameplate label .
- ◆ Detailed description of the failure (Pictures or videos are preferred).
- ◆ Your company name, contact person, address and telephone number.

Information

For after-sales service, please contact the manufacturer or call our service hotline (see details on nameplate label).

6.2 Warranty period

The warranty period is subject to the actual ex factory date of the machine. If you require our company to repair for free during the warranty period, you should contact our after-sales service department and show the serial number on the nameplate.

The following cases within the warranty period do not belong to the free scope:

- ◆ Failure and damage caused by user's improper usage or user's own modification or improper modification.
- ◆ Failure and damage caused by the non-resistance natural factors thunder strike, fire, flood, earthquake, etc, or caused by corrosive liquid and abnormal voltage.
- ◆ Failure or inefficiency due to poor water quality (TDS¹ value greater than 120) and long-term non-maintenance and non-cleaning.
- ◆ User cannot provide valid purchase invoice or valid serial number.

Repair out of warranty period

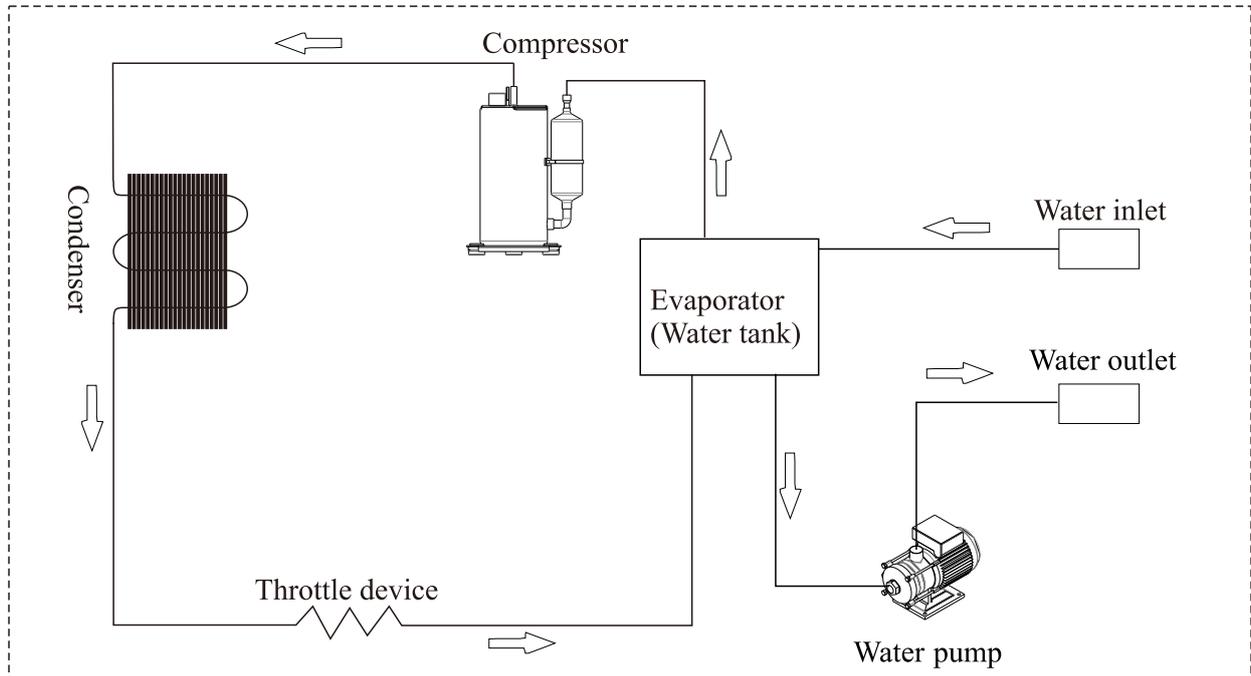
Please contact the manufacturer, the manufacturer will analyze and judge and provide paid services.

Note 1:

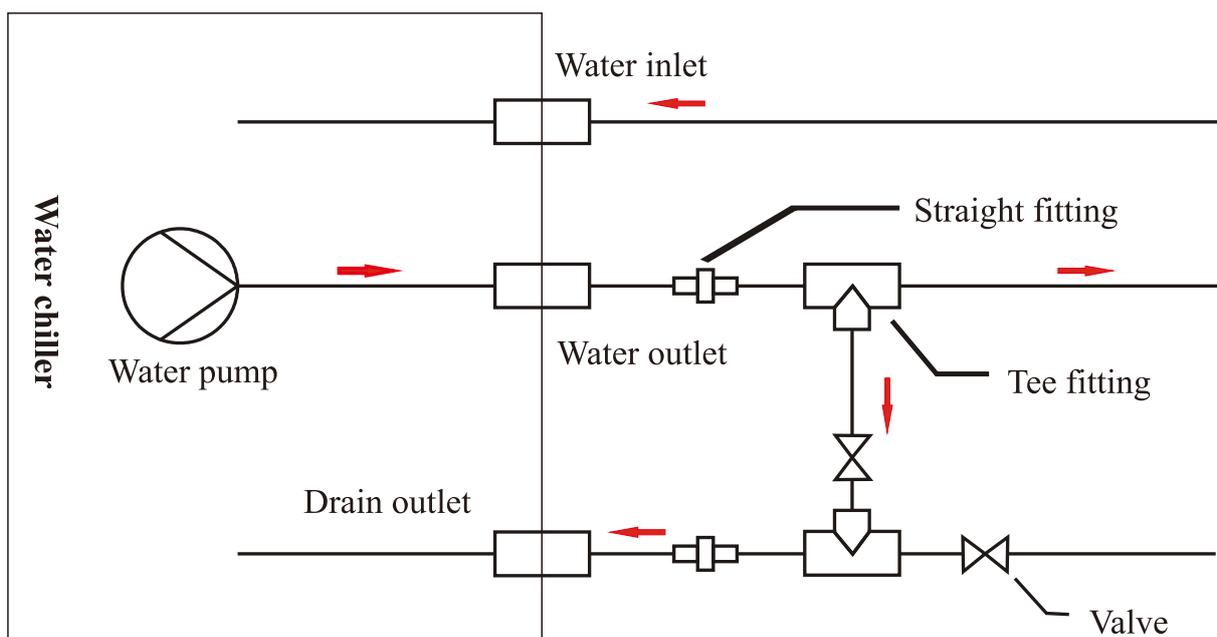
TDS (Total dissolved solids), unit mg/L, It shows how many milligrams of soluble solids dissolve in 1 liter of water.

Appendix

Appendix 1: Schematic diagram of refrigeration system



Appendix 2: Schematic diagram of pipe fitting connection for outlet bypass regulation



Appendix 3: Glycol solution freezing point table

Volume Fraction%	Freezing Point°C	Volume Fraction%	Freezing Point°C	Volume Fraction%	Freezing Point°C
1.80%	-0.6	26.00%	-13	51.90%	-41
3.60%	-1.3	28.00%	-15	53.90%	-44
5.40%	-2	29.90%	-17	56.00%	-48
7.20%	-2.7	31.90%	-18	78.90%	-47
9.10%	-3.5	33.80%	-20	81.00%	-43
10.90%	-4.4	35.80%	-22	83.10%	-40
12.80%	-5.3	37.80%	-24	85.20%	-36
14.60%	-6.3	39.80%	-26	87.30%	-33
16.50%	-7.3	41.80%	-28	89.40%	-29
18.40%	-8	43.80%	-31	91.50%	-26
20.30%	-9	45.80%	-33	93.60%	-23
22.20%	-11	47.80%	-36	95.80%	-19
24.10%	-12	49.80%	-38	100.00%	-13

Appendix 4: Dewpoint temperature table

Dewpoint temp. °C RH(%) Ambient temp. °C	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
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
24		3	6	8	9	11	13	14	16	17	18	19	20	21	22	23
27	2	5	8	10	12	14	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

For example, when the ambient temperature is 32°C and the relative humidity is 65%, the temperature setting value of the circulating water of the chiller should be greater than 25°C in order to ensure that condensate water would not occur in the equipment.

Appendix 5: Comparison Table for Fiber Laser Chiller and Standard Laser Chiller

Water Chiller Type Code for Fiber Laser	Water Chiller Standard Type Code
DLY1000ADH-LD2-AAA-C	DIC010ADH-LD2-AAA-C
DLY1200ADH-LD5-AAA-C	DIC012ADH-LD5-AAA-C
DLY2000ADH-LD2-AAA-C	DIC030ADH-LD2-FAA-C
DLY3000ADH-LD2-FAA-C	DIC040ADH-LD5-FAA-C
DLY4000ADH-LD5-FAA-C	DIC050ADH-LD2-FAA-C
DLY5000ADH-LD2-FAA-C	DIC060ADH-LD5-FAA-C
DLY6000ADH-LD5-FAA-C	DIC080ADH-LD2-FAA-C
DLY8000ADH-LD2-FAA-C	DIC100ADH-LD2-FAA-C
DLY12000ADH-LD2-FAA-C	DIC120ADH-LD2-FAA-C
DLY15000ADH-LD2-FAA-C	DIC200ADH-LA2-FAA-C
DLY20000ADH-LA2-FAA-C	DIC240ADH-LA2-FAA-C
DLY30000ADH-LA2-FAA-C	DIC010ADH-LE2-AAA-C
DLY1000ADH-LE2-AAA-C	DIC020ADH-LD2-AAA-C
DLY1200ADH-LE5-AAA-C	DIC012ADH-LE5-AAA-C
DLY2000ADH-LE5-AAA-C	DIC020ADH-LE5-AAA-C
DLY3000ADH-LE5-AAA-C	DIC025ADH-LE5-AAA-C
DLY4000ADH-LE5-FAA-C	DIC040ADH-LE5-FAA-C
DLY6000ADH-LE5-FAA-C	DIC060ADH-LE5-FAA-C

