

Engineering Data (Installation, Maintenance Manual)

IMM Chiller universal part

Category: Single Screw Chiller

Date: Mar. 2019

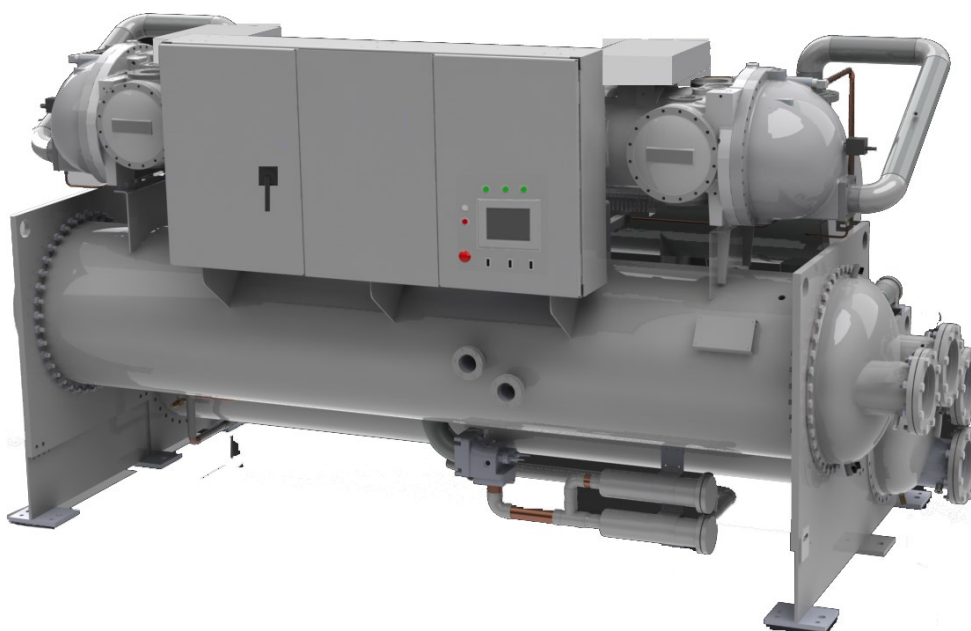
New Part No.: Z8100180-09

Prior Part No.: Z8100180-08

Single Screw Chillers

This manual is applicable to following models and their derived and modified models.

ZUWCM/DM ZUW.C-B ZUWY ZUWV ZUW-HCA



Thanks for purchasing DAIKIN chiller.

The Manual specifies safety, installation and maintenance precautions.

Please read through the manual before installation and use.

For future reference, please be sure to keep it safe.

Engineered for Flexibility and performance



Safety Matters

Single screw chiller can serve safely and reliably under design conditions. Good judgment and safety precaution measures shall be available for operating the chiller to avoid losses of equipment and property or personal in-juries.

Operators must understand and abide by the operation procedures and safety precaution measures in the installation operation and maintenance manual.

Warning

Installation works shall be entrusted to professional installers, otherwise, any improper installation will lead to accidents, such as leakage, electric shock and fire, etc.

Please refer to the Safety Requirement for Cooling and Heating Supply Mechanical Refrigeration System of GB 9237 Standard: Do not place the safety discharge hole of refrigerant in buildings. Refrigerant emissions from the safety valve must be vented to the outdoors, the refrigerant accumulated in an enclosed space can cause suffocation.

Please provide adequate ventilation especially in the closed space with a lower story height according to the GB 9237 Standard. It's harmful to inhale various refrigerant vapors with extra heavy concentration. The refrigerant vapor is higher than the air, so it will reduce the oxygen content in the air, but also cause eye and skin irritation, its decomposition products of thermal decomposition or photodecomposition is also dangerous.

The chiller cannot be installed in the area with potential leakage of combustible gas, otherwise the leaking gas around the chiller may cause fire.

It is prohibited to exceed the specific test pressure and the allowable test pressure shall be confirmed by checking the design pressure in the instructions and on the equipment name plate.

Do not close any valve of the safety devices and please confirm all safety valves shall be installed correctly and operated normally before the operation of chiller.

Beware of any electrical shock. Please disconnect the power supply before touching the motor terminal or connection.

The leakage protector is needed, and the Installation of leakage protector shall be complied with the provisions of a Electrical Equipment Technical Standards and Internal Line Practice. Non-installation or incorrect installation may cause electrical shock accidents.

Each compressor shall have the circuit breaker respectively, and it may cause accidents of electrical shock or fire if one master breaker controls more than 2 chillers.

Processing and welding on the chiller directly are prohibited and it may cause the leakage of chiller and hypoxia of machine room environment.

Only qualified electricians are allowed to work on the electrical equipment.

Do not work on the electric components including control box, switches, and starter cabinet or oil heater before all power supplies have been disconnected and no residual voltage is released from the capacitors or solid state components. Lock the open circuit and mark the circuit during the maintenance. Confirm all the circuits are open before restarting the work if the work is interrupted.

The wrong categories refrigerant or refrigeration oil are prohibited to use, or it may cause the chiller run improperly; the chiller is easy to cause accidents such as fire or explosion when its performance fails to meet the design requirements.

Do not attempt to unload connector, cover plate, etc., when the chiller is under pressures or operating normally. Confirming the pressure is 0kPa before loosening any connector.

Please be careful when assembling the spring to prevent personal injury resulting in sudden release of spring;

Notes:

It's forbidden to clean the pipe or pressure chiller with oxygen and compressed air.

Only refrigerant or dry nitrogen other than air is allowed to use for leakage test.

Walking on the chiller pipeline is prohibited in order to prevent pipeline damage and personal injury caused by refrigerant leakage.

Please use Safety goggles to prevent the refrigerant liquid from splashing into eyes. Please clean the skin with soapy water after it splashes on the skin. Please flush with water immediately and consult a doctor if the refrigerant liquid splashes into eyes.

Inspect safety devices like safety valve carefully at least once a year. Inspect these devices more frequently if the installation environment of chiller is corrosive. Replace safety valve if corrosion or rust or grease stain is detected inside and outside of the valve body.

Do not allow an open flame or steam used for refrigerant cylinders, will lead to dangerous overpressure or it will lead to overpressure hazards.

Do not use the obsolete steel cylinder or attempt to re-charge.

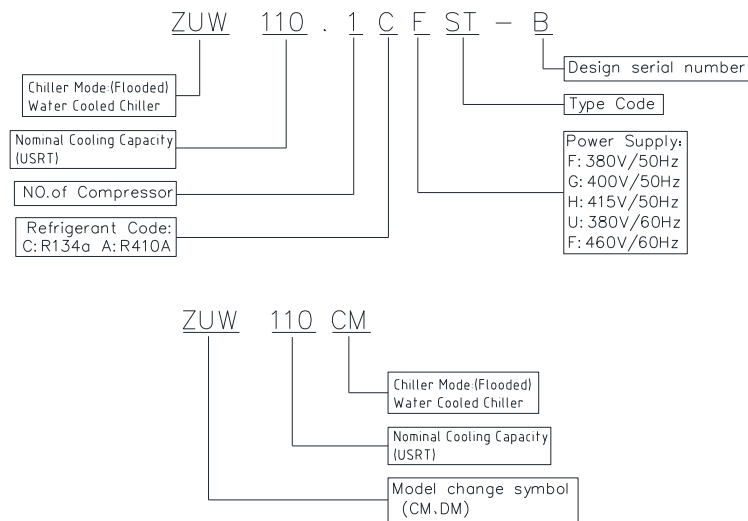
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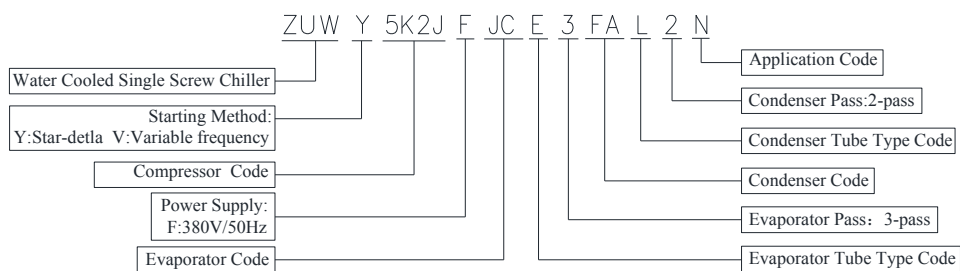
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1. Nomenclature

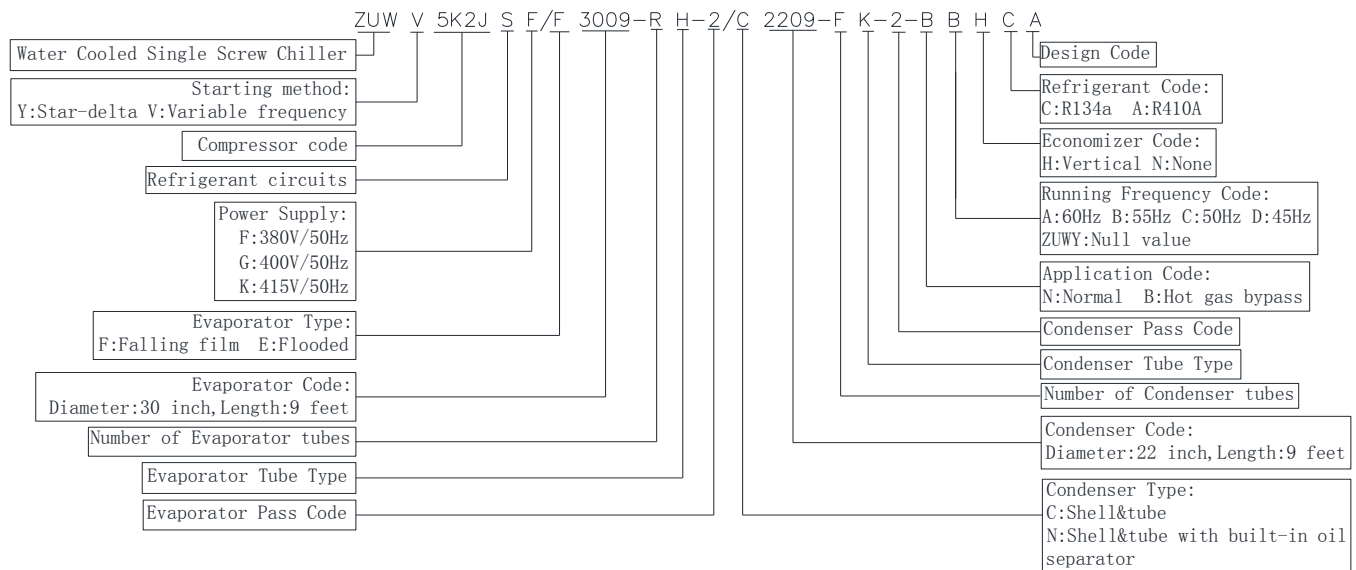
1.1 Water Cooled Single Screw Chiller (Flooded)



1.2 Water Cooled Single Screw Chiller (Falling-film)



1.3 Water Cooled Single Screw Chiller (New Platform for ZUW-HCA)



2. Major Component Locations

Single screw chillers are classified into the single-compressor, double-compressor chillers according to the quantity of compressors, taking the double-compressor chiller(as shown in Fig.2-2),ZUWY6Q2OFLHE3LDL2N falling-film chiller(as shown in Fig.2-3) and ZUWY6Q2OSF-HCA Falling-film chiller with Flash-tank Economizer (as shown in Fig.2-4) as examples to introduce each component of chiller.

All the structures of single screw chillers are similar and different types varies in the aspects of specifications and types; the specific one is subject to the delivery of chiller and the direction of water pipe is in line with the order requirements.

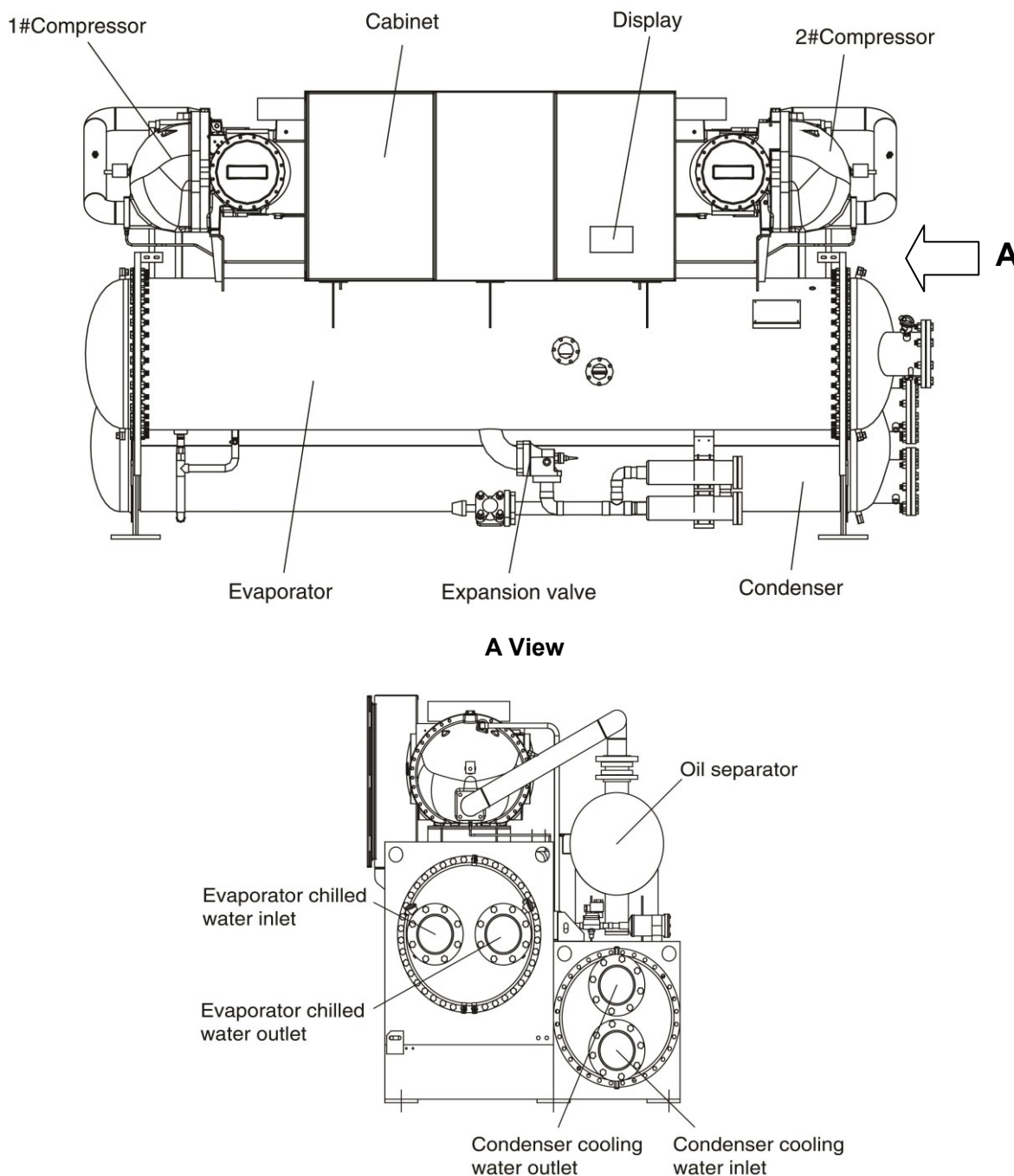


Fig.2-1

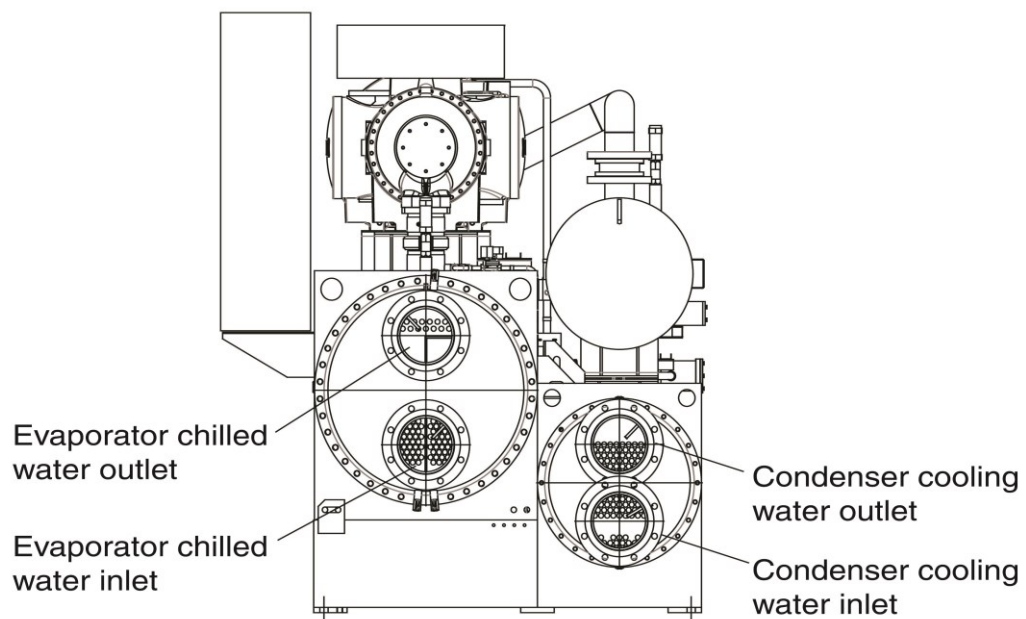
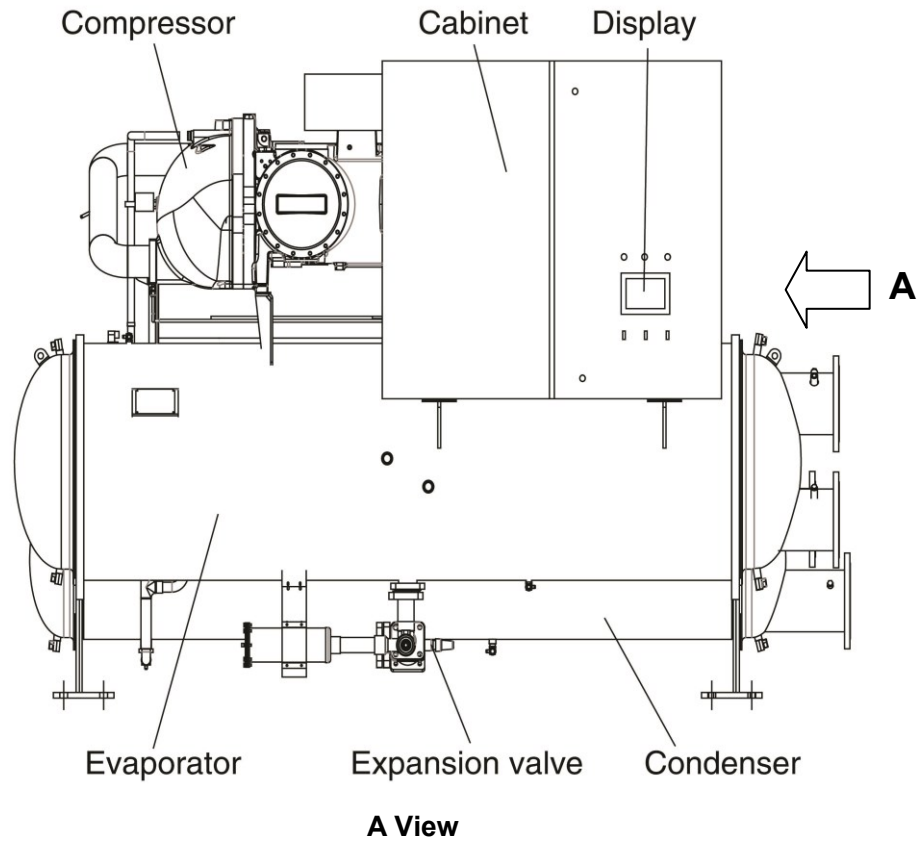
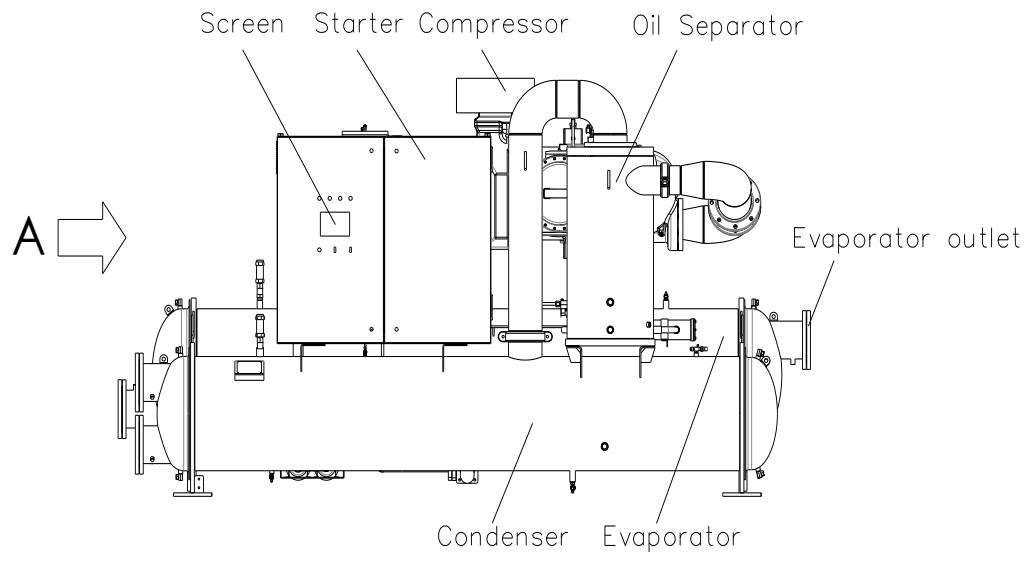


Fig.2-2



A View

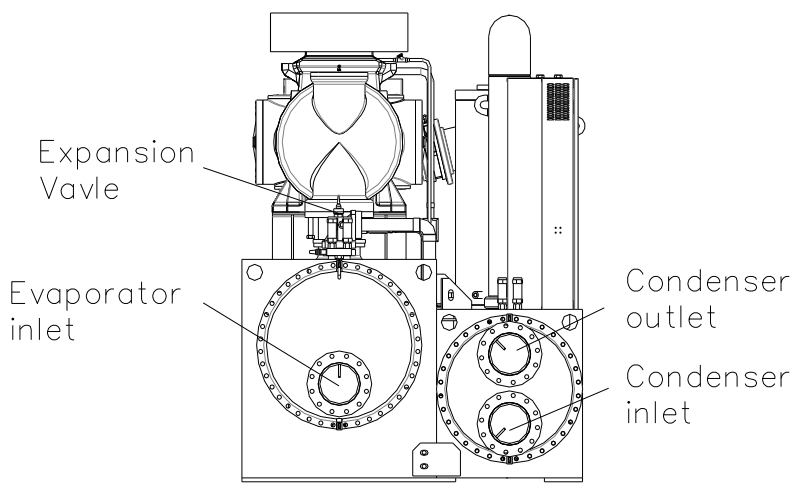


Fig.2-3

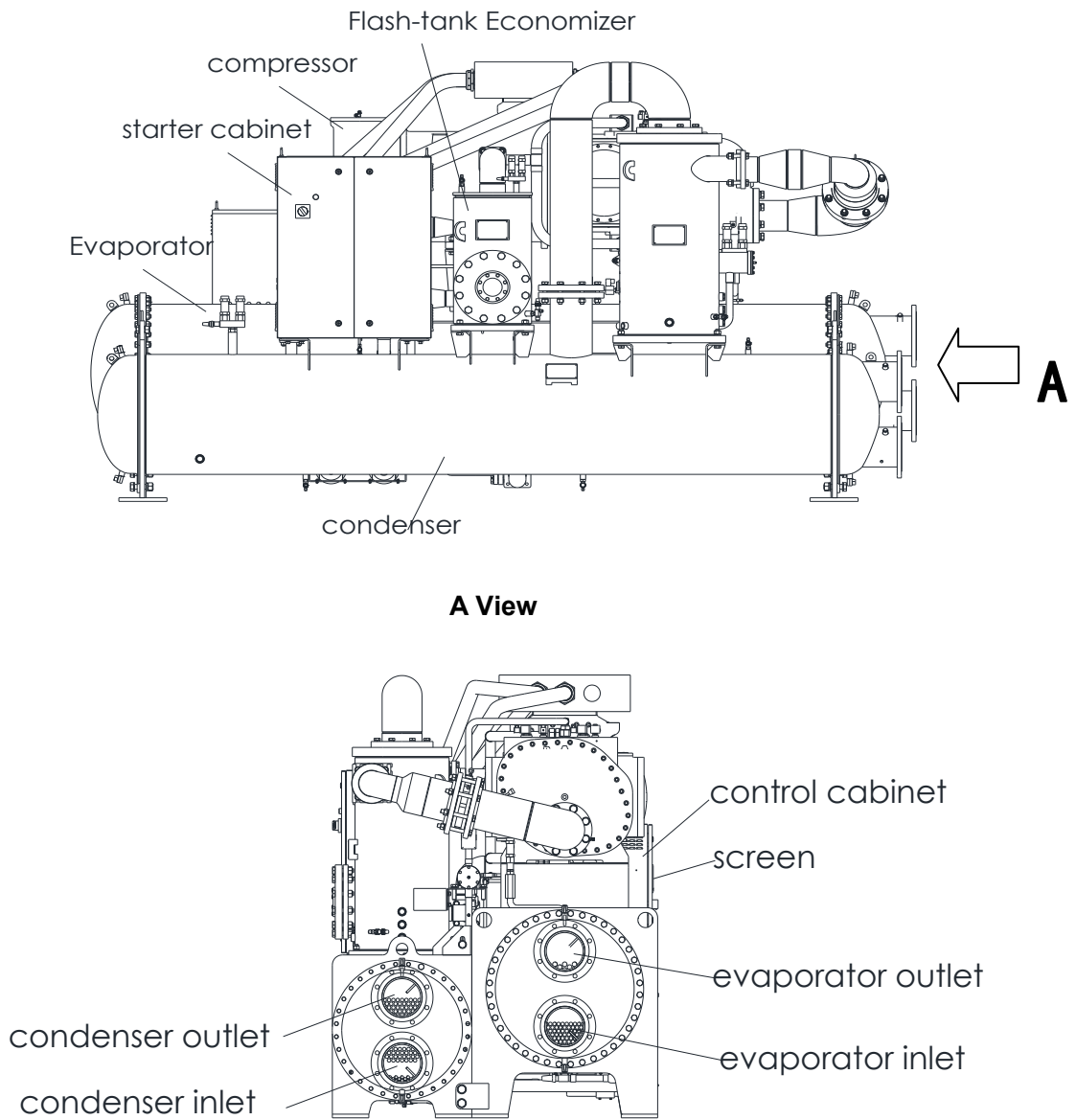


Fig.2-4

3. Working Principles

3.1 Working principles of single screw chiller without Flash-tank Economizer

1. Low temp/pressure refrigerant gas enters the compressor. After compression, the gas will be discharged into oil separator in high temp/pressure;
2. Oil is separated from refrigerant in oil separator. The former goes back to compressor and the later goes to condenser;
3. Refrigerant gas is condensed to high pressure liquid and then goes through expansion valve to the evaporator with low pressure and temperature;
4. Refrigerant liquid absorbs heat from AHUs in evaporator so that the chiller can provide lower temperature water;
5. Refrigerant gas goes back to compressor for the next circulation.

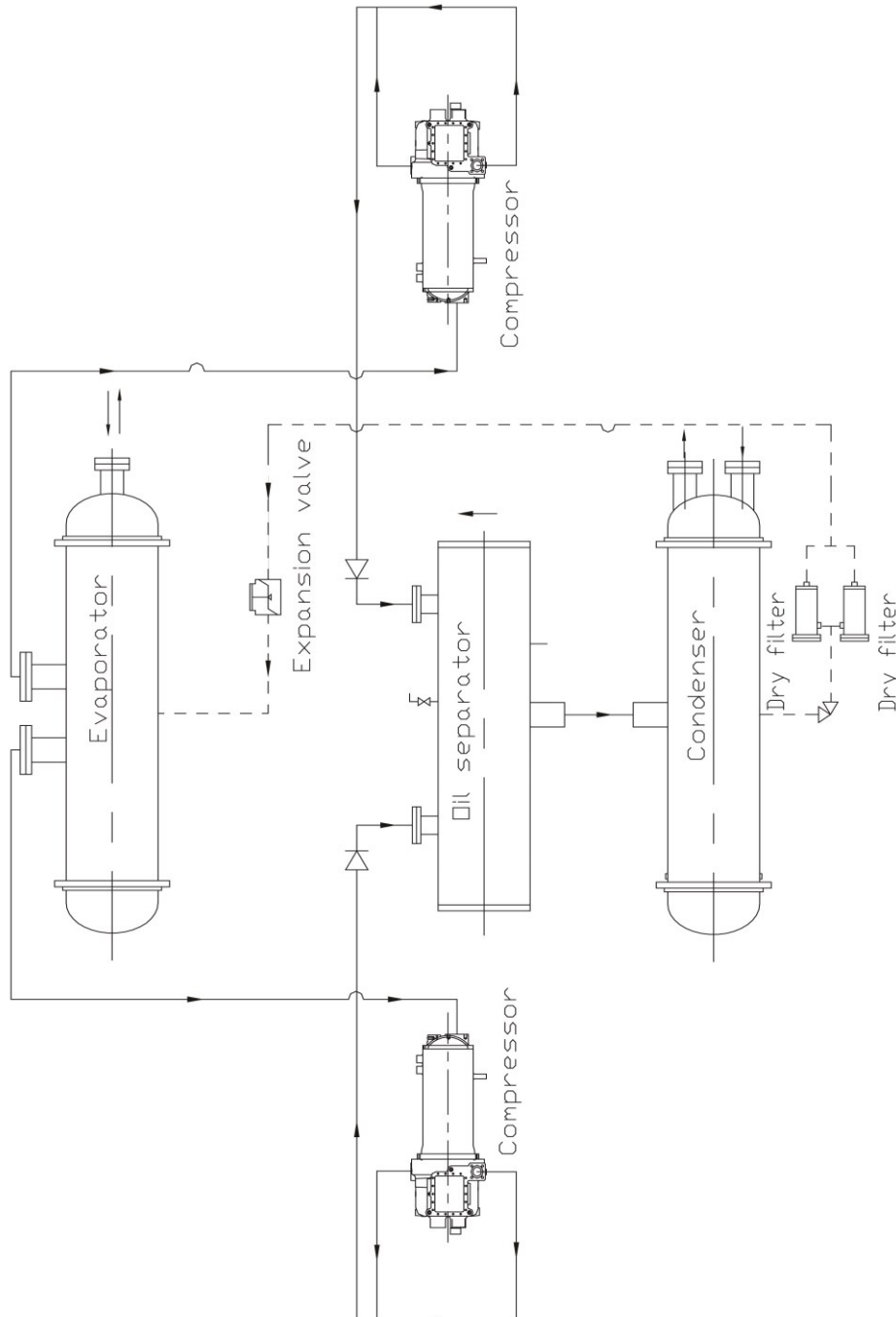


Fig.3-1

3.2 Working principles of single screw chiller with Flash-tank Economizer

1. Low temp/pressure refrigerant gas enters the compressor. After compression, the gas will be discharged into oil separator in high temp/pressure;
2. Oil is separated from refrigerant in oil separator. The former goes back to compressor and the later goes to condenser;
3. Refrigerant gas is condensed to high pressure liquid and then goes through expansion valve to the Flash-tank Economizer. Gas and liquid will be separated in the economizer and the former goes back to compressor and the later goes to evaporator with low pressure and temperature;
4. Refrigerant liquid absorbs heat from AHUs in evaporator so that the chiller can provide lower temperature water;
5. Refrigerant gas goes back to compressor for the next circulation.

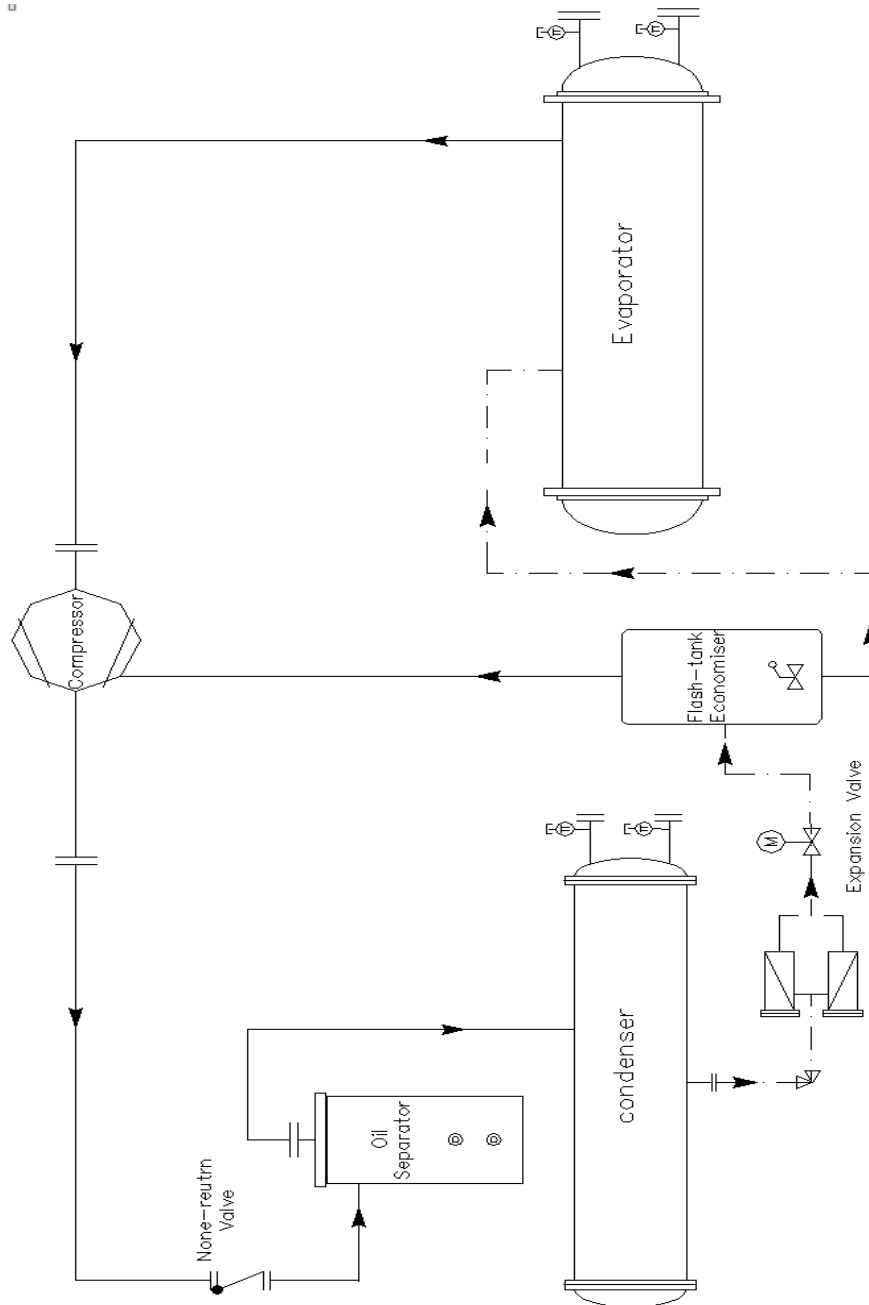


Fig.3-2

4. Safety (Please follow the following content strictly)

Precautions in this section include:

Warning: a faulty operation that may cause death or serious injuries.

Caution: a faulty operation that may cause injuries or equipment failure. It may lead to even more serious consequences according to severity.

Above two precautions are essential for safety, please keep it accessible to each chiller operator after reading the manual, Be sure to hand over the Manual to the next person on duty.

4.1 Precautions during Installation

Make sure chiller is installed as per below requirements, otherwise rectifying measures must be taken.

Warning:

- A) Chiller installation must be carried out by qualified person.

Inappropriate installation might cause refrigerant leakage, electrical shock, fire accident etc.

- B) Prevent refrigerant leakage

In case of refrigerant leakage, certain measure shall be taken to prevent suffocation caused by high concentration refrigerant in air.

- C) Strictly follow this manual during installation

Inappropriate installation might cause refrigerant leakage, electrical shock, fire accident etc.

- D) Electrical cable shall be wired or connected by qualified and professional electrical engineers. Please size the cable according to local electrical standard (refer to the Engineering Data, EDUA14-04-2). Undersize cable might cause electrical shock or fire, etc.

- E) Chiller foundation shall be capable to carry chiller weight

Chiller shall be installed in horizontal foundation and fixed by the anchor bolts. Chiller may overturn if the foundation is not strong enough.

- F) Check the unit alignment

This step operation must be done for Falling-film Chiller. As follows: Check the longitudinal alignment by placing a level on the top center of the evaporator shell. Check the transverse alignment by placing a level on the top of shell end sheets at each end of the unit. The unit should be level within 6.5 mm longitudinally and 6.5mm transversely. When the unit is in place, check that the chiller is level. If the unit is not level within the amount specified, lift it and place as many shims as needed between the isolation pad and the end sheets. As shown in Fig.4-1:

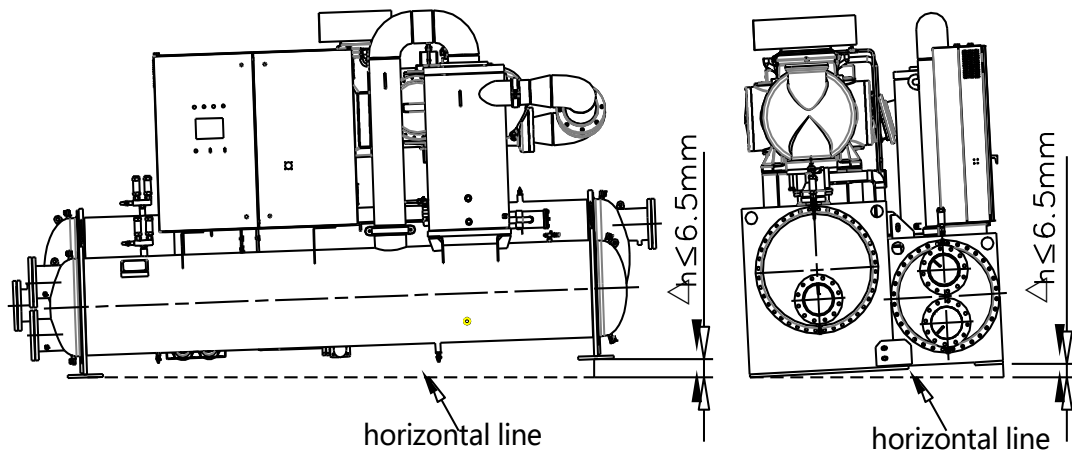


Fig.4-1

- G) Chiller shall be installed in indoor space

If chiller is installed in rainy or water dropping place, electric leakage \ shock might happen.

- H) Use specified cable and ensure the connections are firm

Ensure the connections of cables are firm. Otherwise it may cause fire accident.

- I) Constant pressure leakage test

In case of leakage when unit in constant pressure leakage testing, emptying lubricating oil (if has) and nitrogen and then repair and test again. In case repair is conducted without emptying lubricating oil, it might cause explosion.

Attention:

- A) It is forbidden to install the chiller in flammable gas leakage condition

Fire accident or even explosion will happen when flammable gas concentration achieves certain level.

- B) Chiller shell shall be grounded

Ground cable shall avoid gas pipe\water pipe\lightning rod or telecom cable, wrong grounding might cause shock.

- C) Ground protector shall be equipped for the chiller

Leakage protector shall be installed as per local electrical standard. No leakage protector or improper installation may cause electrical shock.

- D) Each chiller shall be equipped with dedicated circuit breaker.

If only one main breaker is equipped for multiple chiller plant, it may cause shock or fire accident.

- E) Draining system shall be smooth at chiller installation location

A wrong draining system may cause draining failure which in turn may harm chiller electric parts.

- F) It is prohibited to lay the power cables between chillers, otherwise it may cause fire accident.

- G) Chiller plant floor shall go through water proof treatment

Water proof floor will protect chiller from moisture.

- H) It is prohibited to locate chiller in severe environment
Hot well, coast area, etc. will cause chiller corrosion which might cause shock or fire accident.
- I) The water (cooling water\chilled water) in chiller system shall follow the criteria of local water quality standard.
Bad water quality will cause leakage and reduced chiller efficiency.
- J) Follow the local regulations or rules while handling waste brine, cleaning agent, refrigerant, etc.
Illegally discharged waste liquid or gas will harm health and environment.
- K) It is forbidden to close the AC contactor to start the compressor.
It may cause electric shock or fire accident.
- L) It is forbidden to weld on the chiller
Welding on chiller may cause refrigerant leakage. And too high concentration of refrigerant in air will cause suffocation.
- M) It is forbidden to charge other kinds of refrigerant or lubricant oil in chiller.
It may cause chiller instability, chiller efficiency decrease, or even fire accident.
- N) Ensure sufficient space for chiller service and maintenance
Insufficient space will threaten operator or service people's safety.

4.2 Precautions during Use

Warning:

- A) If chiller running abnormally (e.g. smell of burning), please cut off the power and contact local Daikin office or distributors.

Running the chiller after abnormality happen might damage the chiller or shock and fire accidents.

- B) It is prohibited to start or stop the chiller by main breaker or switch during normal working condition.

It may cause shock or fire accident.

- C) It is prohibited to use other category coolant; otherwise it will cause fire accident or explosion.

- D) Prevent leakage of refrigerant

If refrigerant leakage happens, certain measure shall be taken to prevent suffocation caused by high concentration of gas refrigerant in air.

Attention:

- A) Chiller shall not be used for other condition which goes beyond its designed working scope.

It may cause tubes damage, refrigerant leakage or even explosion. Chilled water and heating water can't be used for preserving animals, plants, precision devices, artworks, etc. otherwise it will degrade their quality.

- B) Do not operate the chiller with wet hands.

This is one of the causes of electrical shock.

- C) It is prohibited to use oversized fuse.

An oversized fuse will cause protection failed. And it might damage the chiller or cause fire accident.

- D) It is prohibited to localize the chiller in flammable gas circumstance.

It might cause fire accident.

- E) It is prohibited to operate contactor to start the chiller manually.

It may cause fire accident or electrical shock.

- F) It is prohibited to bypass chiller protection device to start the chiller.

It may cause fire accident or explosion.

- G) It is prohibited to start the chiller when open the starter cabinet door.

It may cause electrical shock or fire accident.

- H) Ensure the power supply is correct.

Using the power supply other than the rated one specified on chiller name plant might cause electrical shock or fire accident.

- I) It is prohibited to change the protection set point.

It may cause fire or explosion.

- J) It is prohibited to put or hang any object upon the chiller.

Dropping of the object might damage the chiller.

- K) It is prohibited to put any container which contains water on the chiller.
If water seeps in control cabinet, the insulation may become worse or even cause electrical shock.
- L) Check the foundation after chiller operates for certain period.
Unstable foundation may cause chiller distortion or even accident.
- M) Stop the chiller and cut off the power supply when cleaning the chiller.
Otherwise it may cause accident.
- N) It is prohibited to flush the chiller.
It will cause electrical shock.
- O) It is prohibited to drink chilled water or cooling water
It's not healthy to drink cooling or chilled water.
- P) Water quality must be ensured.
Bad water quality might cause chiller capacity reduce or water leakage.
- Q) Do not feed other category of refrigerant or oil in chiller
This might cause chiller operating abnormal or efficiency reducing. And it is also a cause of fire or explosion.
- R) Do not touch the compressor and discharge pipes.
It will cause scald.
- S) Drain the water in chiller unit if chiller will stop for a long time.
Before long period stop, drain the water or add anti-freeze in chiller, or it might cause chiller water side leakage or refrigerant side leakage.
- T) Treat the chilled water\cleaning agent\wasted refrigerant according to local rules
Illegally dump the waste will break the law and harm environment.

4.3 Precautions during Relocation and Repair

Warning:

- A) Chiller transit and service shall be done by vender
Inappropriate installation will cause electrical shock or fire accident.
- B) Chiller relocation shall be done by chiller vender.
Inappropriate relocation will cause electrical shock or fire accident.
- C) It is prohibited to modify the chiller without Daikin authorization.
Unauthorized chiller alteration will cause electrical shock or fire accident.

Attention:

- A) Client shall follow the local regulations or rules when handling the wasted chilled water, cleaning agent and refrigerant.
It is harmful to the environment and health.
- B) Do not mix with other categories of refrigerant or oil in chiller.
It may cause fire accident or explosion.

C) It is prohibited to change the set point of protection device.

It may cause fire accident.

D) It is prohibited to bypass the protection device when starting the chiller

It will cause fire accident.

E) Ventilation is required during chiller servicing.

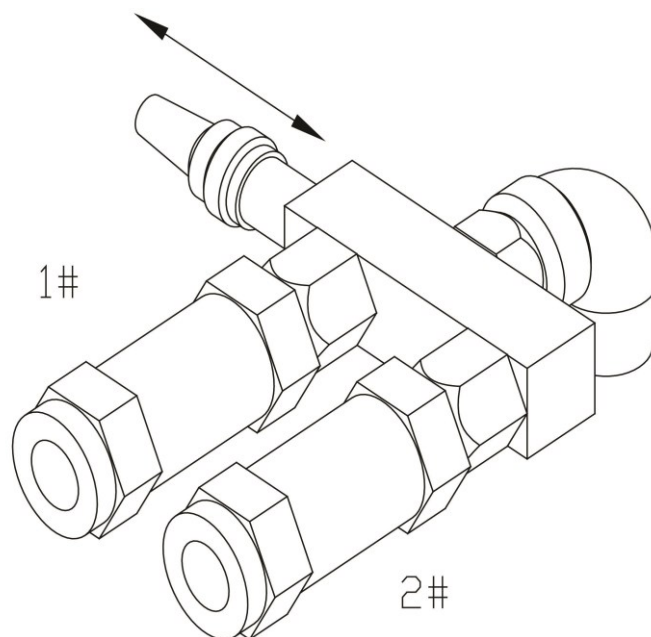
Refrigerant leakage will reduce the concentration of oxygen. So it may cause suffocation when ventilation is insufficient.

4.4 Notes for Relief Valve

Each system will be equipped with a relief valve on the top of the evaporator and oil separator (No relief valve on the condenser because it connects the oil separator) in order to release the pressure of vessel when it is too high.

The relief valve installation for double valve design, adjust the tee globe valve stem so that when a valve is under repair, the other valve can still work. the specific structure is shown as below.

Note: When the tee globe valve stem is the shortest, 1# relief valve is open, When the stem is the longest, 2# relief valve is open.



Relief Valve Operation

Note:

- 1) If the 3 way valve pin is in lower limit position(shortest), 1# valve is open;
- 2) If that pin is in lower limit position(longest), 2# valve is open.

Fig.4-2

If local regulations required, so in the safety valve to connect one emptying pipe to the outdoor (Daikin advices that customers installation emptying pipe). Refer to below; the connected pipe of relief valve must use flexible connectors.

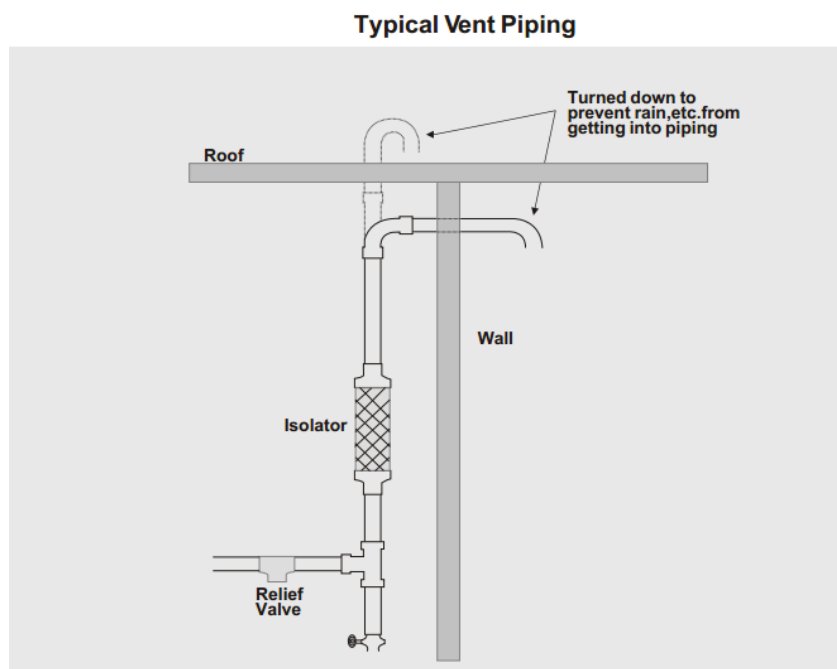


Fig.4-3

Note: Before connect the pipe, Need to remove the plastic plug in the valve (if any), According to the local regulations.

When the emptying pipe is installed to the relief valve, the dimension of emptying pipe is based on the size of one relief valve. Then it is connected to two valves.

The connected type of relief valve is FPT1 (internal thread NPT1). There are two relief valves installed on the oil separator, If one is damaged, adjust the cut off valve to isolate it, and the other relief valve can protect the system, at the same time, the damaged valve could be changed.

To set the pressure of relief valve, please refer to the Engineering Data, EDUA14-04-2.

Note: 1 inch pipe is too smaller for the valve; the reducing tube must be connected on the valve outlet.

The equivalent lengths of reducing connectors are shown below:

Equivalent length (m)	<0.67	0.67~5.6	5.6~32.2	32.2~90.4	90.4~296.8	296.8~1255
Reducing connector(NPT)	1 1/4	1 1/2	2	2 1/2	3	4

When from more than one line into the public joint, the public joint's area cannot be less than the total area, the following equations can be calculated:

$$D_{\text{总}} = (D_1^2 + D_2^2 + \dots + D_n^2)^{0.5}$$

D1, D2, Dn: the area of each branch line.

5. Chiller transit

5.1 Checking items after chiller arrival

Check chiller model and quantity, inspect whether there is damage on the appearance.

Chiller injury or parts\document loss caused by client is not in warranty scope.

If client ordered options like spring isolator\flow switches\electric butterfly valve etc., Daikin will put them in accessory box and deliver together with chiller.

If you requires differential pressure controller configuration, it has been installed on the machine for you;

Daikin will offer flange or Victaulic groove on evaporator & condenser pipes for customer water system connection.

5.2 Chiller Lifting

The lifting mode is shown in Fig.5-1. Parameters on nameplate shall be taken as the criteria for dimensions and weight.

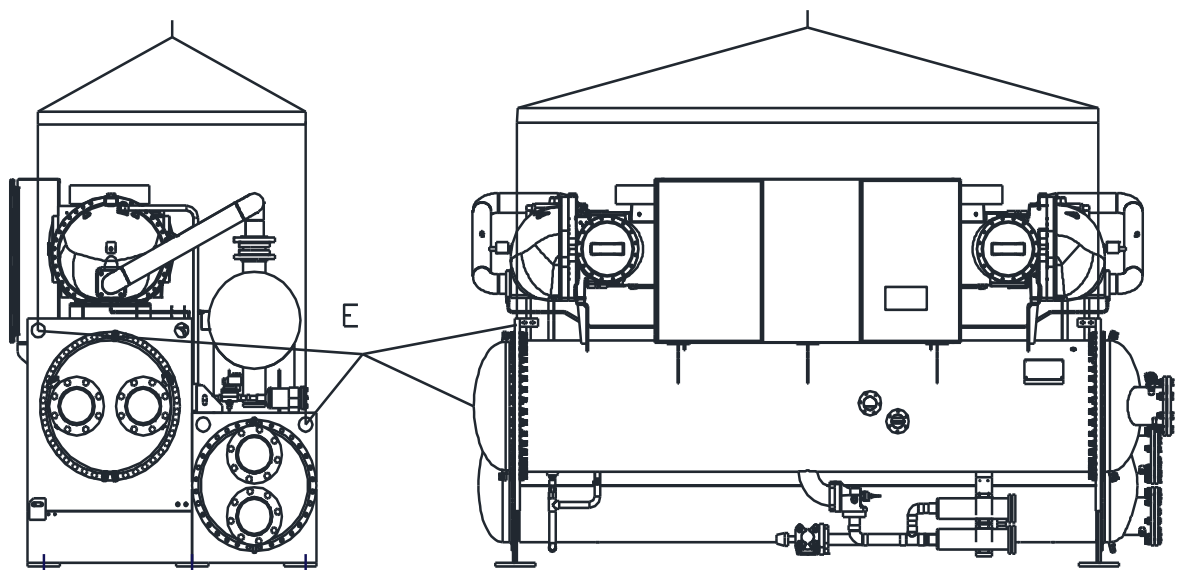


Fig.5-1

5.3 Lifting Requirements of Chiller

- A) It is only allowed to lift with the marked lifting location on the chiller. (Lifting hole as Fig. 5-1 "E")
- B) Ensure chiller is horizontal when lifting.
- C) It is recommended to use cable or chain to lift the chiller via the lifting holes marked on the chiller to prevent damage during lifting.
- D) In case chiller can't be lifted via the lifting hole. Client might use cable to frap the condenser and chiller before lifting. But it is forbidden to lift the chiller via compressor or starter lifting lug.
- E) Chiller shall be located in horizontal foundation and sufficient space shall be provided on top for lifting
- F) Certain protection for starter is required during lifting with method D.

G) During lifting, use fabric to cover the chiller so as to protect it from injury.

Warning:

A) Do not use compressor or starter lift lug to lift the entire chiller

B) The lifting cable shall not contact chiller pipes. It might crack the pipes.

5.4 Horizontal transiting

To prevent bending of chiller main foundation, please pay special attention when handling.

As copper tubes is located under the chiller. Please be careful not to scratch the lower part of chiller when tilted or moved across the stage.

6. Installation

6.1 Chiller location and foundation

- A) Chiller shall not be located in rainy or exposed directly under the sun. If chiller is placed near beach or chemical plant etc., corrosion might occur to electronic parts or chiller painting. Special condition is required as per special chiller design. Please consult the local sales office for details.
- B) Please install proper ventilation device so as to prevent suffocation caused by refrigerant leakage.
- C) ZUW chiller is not designed for explosion condition. It is forbidden to install the chiller in flammable gas space.
- D) Chiller plant temperature shall be within 3°C~40°C. Relative humidity shall be less than 90%. Temperature fluctuation shall be within 8°C/hour.

If chiller is installed in cold area, anti-freezing measure shall be taken not only for chiller but also for other device in chilled water and cooling water system.

- E) It is not recommended to put chiller and boiler in the same plant. It will affect chiller performance. Please confirm with local sales office and distributor if required.
- F) It shall keep certain distance between cooling and easily corrupt metal\electrical parts etc.

Locate the cooling tower in appropriate place to avoid cooling water contamination. It is forbidden to locate the chiller near coast\plating plant\chemical plant etc. where the cooling water might be contaminated. Check cooling water periodically. And chiller shall keep certain distance from ammonia device\toilet and surgery vent\cloaca. Otherwise condenser tube corruption might cause refrigerant leakage. If client use sea water or river water as the cooling water, then special design of condenser shall be used.

- G) Chiller shall be installed in the place which is not sensitive to vibration or noise.

Isolator of vibration or noise should be used if chiller is installed in noise and vibration sensitive place.

The vibration may come from installation location, floor or wall; thereby the chiller plant room should be set at bottom floor of the basement.

- H) Please locate the chiller where the chiller's weight is bearable.

- I) For easy drainage, the chiller foundation should be higher than its surrounding.

Water proof treatment is suggested for the floor to ensure maintenance of the chiller.

Please locate the drain and auxiliary facilities surrounding the chiller. It is forbidden to install the chiller in potentially flooded area.

- J) For regular maintenance, please consider the light condition of the chiller. Please install lights for insufficient lighting condition.



Fig.6-1

If chiller is installed in the building of the middle layer where excessive vibration may occur, please use the spring anti-vibration device. Daikin offers spring isolators according to the user's requirements.

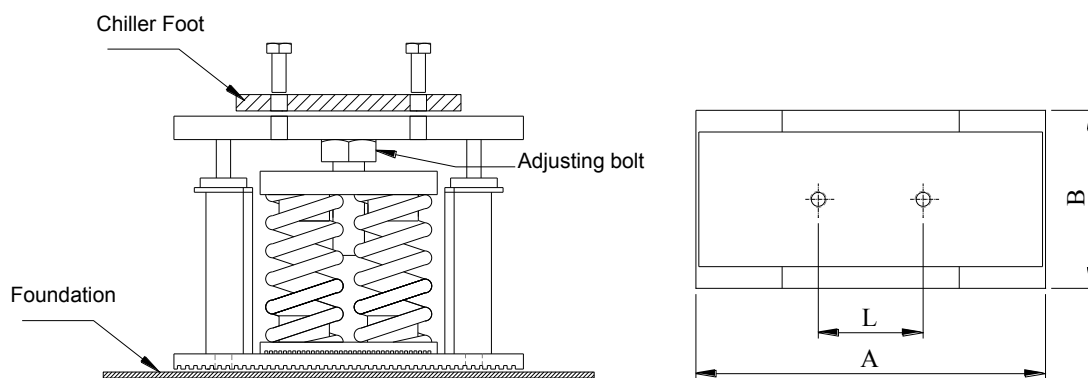


Fig.6-2

In Fig.6-2, it is used for the spring isolator mounting, in which AB is the edge length of the spring isolator and L is the distance between the two bolt holes on the bottom. Anchor the spring isolator with bolts at two holes on the bottom plate, and then tighten the lock nuts.

Spring isolator can be placed directly on the concrete ground as the rubber can prevent vibration and slipping. If there are spring isolators, anchor bolts will not be required.

The location of the four spring isolators is the same to anti-vibration pads shown in Fig.6-1, the two holes in each corner match the two bolts on spring isolators.

6.2 Knockdown of Chiller

The chiller is delivered in three states: 1. complete chiller with refrigerant and lubricating oil; 2. complete chiller without refrigerant, but with lubricating oil; 3. the chiller is partially or fully dismantled. Reinstallation of the chiller in the second or third state shall be performed by professional operator as per the General Assembly Schematic Map of the chiller. Level pressure and inspect leakage condition of the chiller after reinstallation, and vacuum the chiller after leakage condition being inspected.

1. Nitrogen leakage detection

Open the pipeline valve to inject the dry nitrogen into the system, and let the pressure rise up to 0.4MPa and hold this pressure for 5 min, and then inspect all of the welding connections and connection positions for leakage. If any leakage detected, discharge the refrigerating engine oil (if provided in the chiller) and nitrogen out of the chiller, and repair the leakage position, then, perform the inspection again. If the chiller approved as qualified by the first inspection, further increase the pressure to 80% of the prescriptive value slowly (if the test pressure exceeds 2.0MPa, then, it is only need to increase the pressure to 50% of the prescriptive value), and hold this pressure for 5 min, and then inspect all of the welding connections and connection positions for leakage for the second time. If any leakage detected, discharge the refrigerating engine oil (if provided in the chiller) and nitrogen out of the chiller, and repair the leakage position, then, perform the inspection again. After approved as qualified by the second inspection, increase the test pressure to the prescriptive value step-by-step, and the pressure increased at each step shall be 10% of the prescriptive value. Close the valve to maintain the pressure for 60 min after the system is confirmed as free of leakage and the pressure meter shows that the pressure is the leveled and leakage inspection pressure. During this period, inspect the pressure shown by the pressure gauge. The pressure shall remain unchanged unless the environment got changes which may result in fluctuation to the pressure. If the pressure suffers any change, it is also need to discharge the refrigerating engine oil (if provided in the chiller) and nitrogen out of the chiller, and carry out necessary repairing work, then, perform the inspection again.

Test pressure of the nitrogen leakage detection for each chiller is 1.0MPa.

2. Vacuum Test

While performing vacuum test, each part of the refrigerating system shall be free of abnormality after vacuuming the chiller to 67 Pa (500Microns); hold this pressure for 30min during which the rise of vacuum degree shall not exceed 67 Pa (500Microns).

3. Charging of the Refrigerant

Charging volume shall be determined according to the nameplate.

6.3 Piping of the chillers

The schematic map (Fig. 6-3) of water connecting pipe for single screw chiller is provided only as a reference.

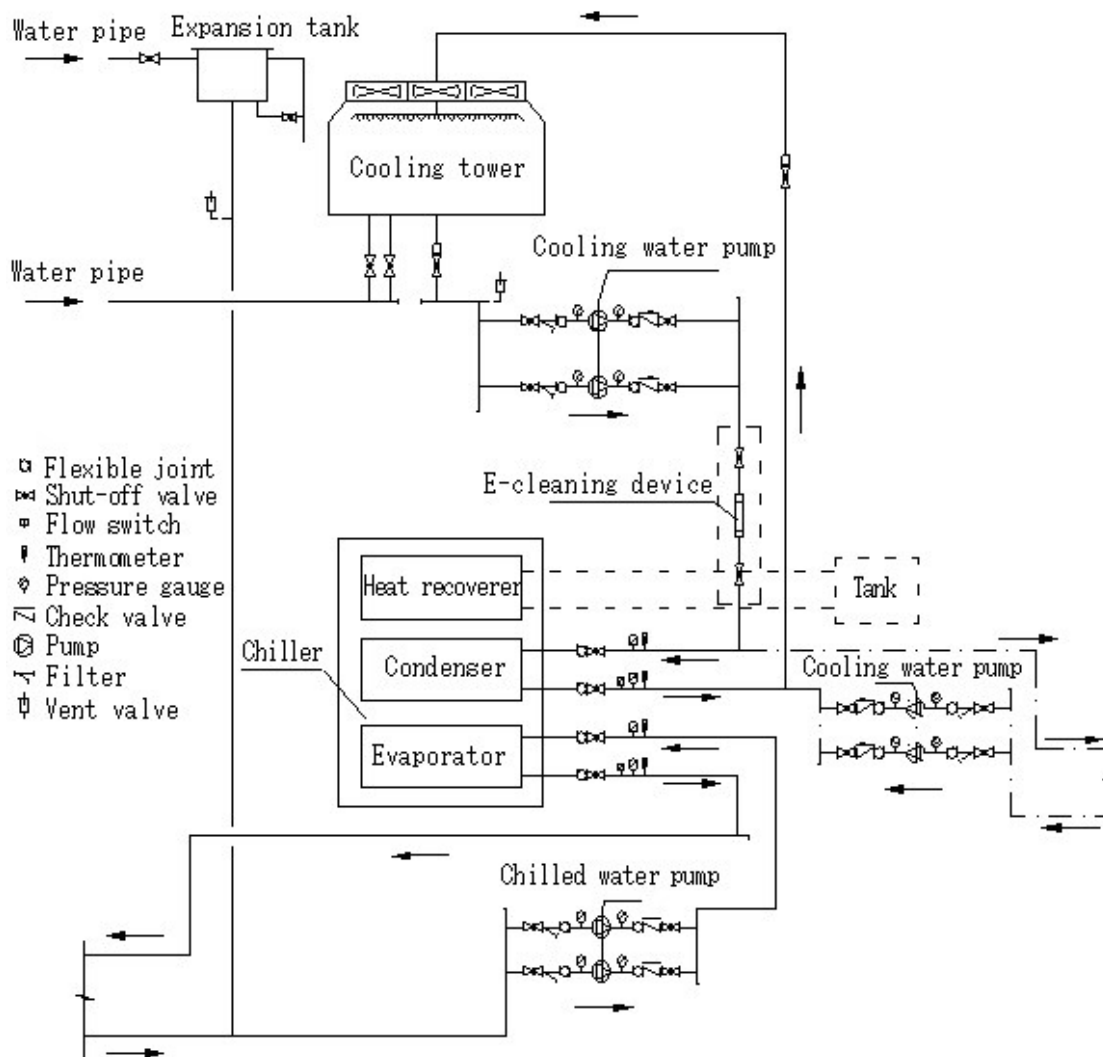


Fig.6-3

A) Anti-Vibration

1. To limit the spread of vibration which would affect other equipment, flexible joints for the unit connection pipe installation are suggested.
2. Please install proper number of the pipeline support.
3. Ensure that the unit in and out water pipe will not bear the excessive force on equipment.

B) For proper Flow Rate:

1. Check the air tightness of pipe works before connecting chillers.
Notices: Ensure the correct connection of condenser and evaporator inlet/outlet pipeline.
2. Please use the same or greater diameter pipe to the chiller connection.
3. Flow regulation valve (if any) must be set in the central of entrance pipe nearby the unit, it is suggested to install the valve on horizontal pipe. The pipes before and after the valve shall be straight with a length of 5 times the pipe diameter.

4. Inlet/outlet of the water pipe should be equipped with pressure gauge to calculate the pump running status according to the characteristics of the pump.
5. Qualified water flow detecting devices must be installed on each chiller water pipe, such as water flow switch or differential pressure switch interlocked to the chiller controller.
6. The chiller would control the cooling water pump, chilled water pump and cooling tower fan on and off, so as to achieve best efficiency of energy saving and reliability.

Caution: Chiller flow detecting device shall be interlocked with pumps. When the flow metering device detects the flow rate is insufficient or no flow, chiller won't start but trip. If the flow detecting device is not connected with chiller controller, the protection will not be active and client must ensure the pump start and flow is established before chiller start. Otherwise Daikin won't be responsible for any loss caused by this.

C) Eliminate the impurities in water loop

1. Strainer and drain pipe shall be installed in water loop.
Sand\muck\rust in water loop will corrupt metals such as chiller tubes.
2. The strainer shall be installed near and in the inlet pipe of chiller
Please use 40 mesh filters.
3. Check the filter and drain port periodically.
Consider its service space during installation.
4. In order to easily clean chiller tubes, isolation valves are requested for both inlet and outlet chiller pipes. To easily remove the water box, please use flexible pipe connection in both chiller inlet and outlet pipes.
5. Install ventilation valve and draining valve in water loop for water system inspection or cleaning use. Connect the draining valve and gutter.

D) Prevent air mix in water loop

1. Install ventilation valves to ventilate the air in the system.
Air in water system will reduce chiller efficiency and shorten service life of tubes.
2. Be careful on the water flow rate, too high flow rate will cause tube cavitation, etc.
3. Too much oxygen in water will increase water causticity.

E) Follow the chiller operation guide

1. Please ensure chiller operates within the maximum working pressure.
2. Please execute according to the recommended temperature range of the chiller condenser stated in [chiller parameters part].
If the temperature does not fall in this range, the performance and the service life of the chiller will be affected.

F) Pipe and tube internal anti-corruption treatment

1. It is forbidden to install grounding cable on water pipe to prevent electrical erosion.
2. Anti-corruption treatment shall be taken for buried pipes.
3. Prevent condenser and evaporator from water and air interface.
Refer to recommended water quality [Chapter 11.3 Chiller water quality requirement].
4. Add corrosion inhibitor to chilled water (Glycol, CaCl_2)

Coolant (Ethylene glycol, CaCl_2 , etc.) should have a pH between 8 and 9, the reserve alkalinity should be between 16 to 21.

G) Anti-freezing measures

1. Sufficient thermal insulation and damp proof are requested. If not, it will lead to heat loss or damage of tubes in cold winter due to freeze.
2. If the ambient temperature is below 0°C , heat the water in chiller tubes to prevent freezing.
3. Chiller plant room might equip heater to prevent water freezing in chiller unit.
4. If chiller seasonally stop in the plant room where temperature goes below 0°C , operator must drain the water in chiller tubes. Otherwise Daikin won't be responsible for the damage or loss caused by this.
5. Notice the water inlet/outlet indications when connect the chiller to the water system.

H) Starting countermeasures to low cooling inlet-water temperature.

The piping methods listed below is recommended specific to the low cooling inlet-water temperature condition.

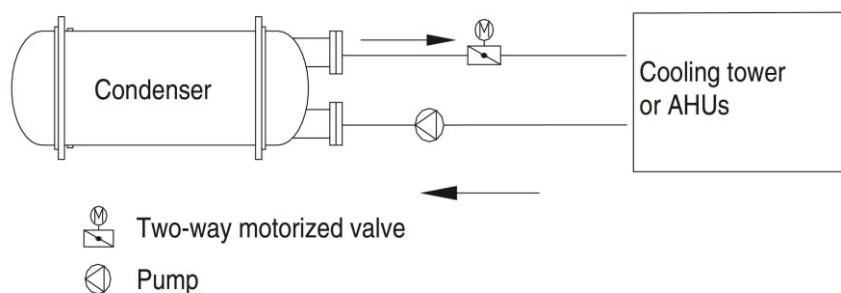


Fig.6-4

As shown in the figure, the two-way motorized valve is installed in the leaving pipe of cooling water, and the water inflows into the condenser is controlled by high-low pressure difference through enlarging the opening of the two-way motorized valve while the high-low pressure difference is greater than a certain value, and narrowing the opening in reverse circumstance.

6.4 Electric Works

A) Confirm that the wiring is connected.

Confirm that the wiring is connected correctly, and anti-phase or default phase is not allowed.

Please be noted that the port connection position shall not bear any external force during wiring.

Check the wires to confirm all of them are connected correctly.

Refer to [chiller Technology Parameters] for wiring specifications.

B) Ground wire connection

To avoid electric shock, the wiring terminal of control cabinet and the grounding bolt on the chiller base must be grounded.

Wire connection works must be performed by the qualified professionals.

Grounding resistance shall be below 0.1Ω .

Attention: Ground cable shall be kept certain distance with natural gas lightning rod and telephone cables. And don't connect water pipes to ground cable.

Gas pipeline – gas leakage may cause explosion and fire.

Water pipe – the grounding will be invalid if the water pipe is made of hard ethylene materials.

Telephone grounding wire and lightning rod – grounding voltage may rise abnormally in thunderstorm weather.

C) Precautions during installation

Caution: Clean the ash on the electrical components in control cabinet before starting the electric work.

Don't break the terminals during cable connecting.

Clean the cabinet and tools when above work is finished.

D) Attentions during the wiring construction of power cable

AC power cable should not be worn in the metal conduit (metal trough) alone

The same AC loop cable should be worn in the same metal conduit (metal trough), and the connectors should not be found with the cable inside the metal conduit (metal trough)

The wiring construction of power cable for example:

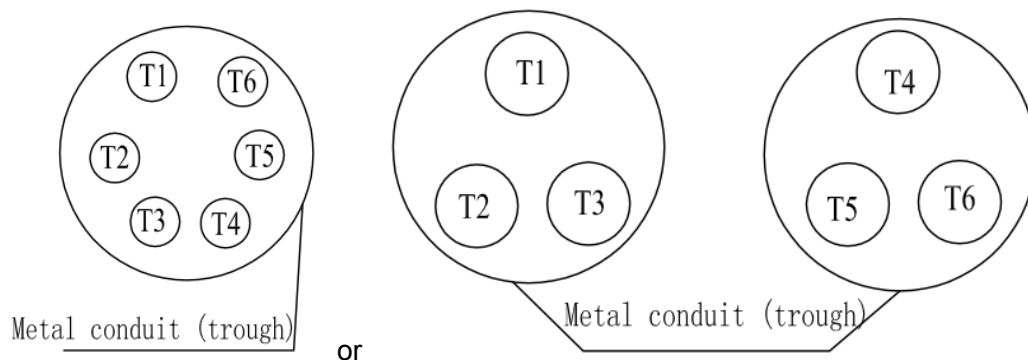


Fig.6-5

Note: the PE cable could be worn in any metal conduit (trough), T1, T2, T3, T4, T5, T6 corresponds to the compressor motor terminal 1, 2, 3, 4, 5, 6 which draws forth the power cable.

7. Matters to be Confirmed before Test Run

To ensure personal and equipment safety, the items listed below shall be inspected before performing test run.

It is necessary to read [4.Safety] to ensure safety for equipment.

If the inspection results failed to conform to relevant requirements, the test run shall not be performed, and a negotiation with Daikin shall be conducted.

7.1 Inspect the power circuit (please confirm before it being powered up)

A) Insulation resistance of power circuit

It must be confirmed before being powered up.

It shall not be below $2M\Omega$ in 380V/3P condition.

B) Power should be connected correctly.

Ensure no reverse phase, lacked phase.

Please make sure power cable connection point no misplacement.

C) Chiller housing should be grounded.

Ensure correct grounding as per outside wiring requirements.

D) Control cabinet interior must be cleaned.

Clear the dust produced during installation and electrical works before the cabinet being powered up.

7.2 Acknowledgement of cables (before being powered up)

A) Interlock circuit of pump should be connected correctly.

Please check interlock signal of pump.

This contact point is very important as one of protection device.

B) Ensure correct contact point position.

Ensure no-voltage loop is not connected with voltage loop.

Double check contact capacity is no problem.

C) Check if cables connection is correct.

Please ensure no cross connection or miss-connection.

D) Ensure terminals are tight.

Please ensure terminals not tilted.

Possible looseness may cause cross input/output signal, even cause fire hazard.

7.3 Power supply check

A) Power supply should meet requirements

According to all parameters on nameplate, please confirm voltage is within $\pm 10\%$ of nominal voltage, frequency is within (50) $\pm 2\%$ Hz, and phase voltage unbalance is within $\pm 2\%$ of rated voltage.

- B) Power on more than 8 hours before operation.

In order to start compressor smoothly, starter cabinet should be powered on more than 8 hours to energize oil heater to heat the oil.

7.4 Water system check

- A) Water should be filled in pump.

Open water pump to fill water in system, meanwhile discharge all air of the water system by slowly opening vent valve on the top of evaporator and condenser and closing it when water overflowing. Air mixed in system will reduce performance.

- B) Water side pressure should be specified value as shown below

Please ensure water side pressure of evaporator/condenser water. Except for water pressure above, hydraulic pressure during pump start-up also needs to be confirmed, if it exceeds the max allowed water pressure, chiller may be damaged;

Please observe the requirements of maximum pressure stood by water side stated in the chiller contract.

- C) Leakage check

Ensure no leakage at flange, bushing and connector.

- D) Ensure no air mixed

When water has noise, water pressure changes during equipment installation, or amps of pump is not steady etc., it's possible that air is mixed in water system, in this case, please discharge air again.

Mixed air not only reduces chiller performance, but also may cause evaporator/condenser tube damage due to increasing water corrosion.

- E) Check if flow adjustment is finished

Adjust to proper flow as per flow meter or pump characteristic chart.

For condenser, too small flow will reduce chiller performance, meanwhile impurity in tube and fouling will cause corrosion damage, and too big flow will cause corrosion.

For evaporator, too small flow will reduce chiller performance; and too big flow will cause scouring and Carmen whirlpool effect to exacerbate friction between tubes and clapboard, even lead to leakage.

7.5 Check chiller

Chiller is designed with valve due to operation and service, please confirm every valve's status before start-up.

The status of every valve is shown as below:

Installation Position※	Description of Valve Application	On-off State
Upper Part of Evaporator	Safety Valve	On ※※
Upper Part of Evaporator	Refrigerant charging valve	Off
Lower Part of Evaporator	Pollution discharging valve	Off
Bottom of evaporator head	Drain valve	Off
Top of evaporator head	Vent valve	Off
Rear of Evap. (near Cond)	Oil return valve	On
Top of condenser	Refrigerant discharging valve	Off
Bottom of condenser	Pollution discharging valve	Off
Left of Cond (facing starter)	Liquid control valve	On
Bottom of evaporator head	Drain valve	Off
Top of condenser head	Vent valve	Off
Top of oil separator	Safety Valve	On※※
Bottom of oil separator	Oil discharging valve	On
Bottom of oil separator	Pollution discharging valve	Off
Suction Pipeline	Suction valve (if available)	On
Oil Return Pipeline	Drainage tube ball valve (if available)	On
Liquid Supply Pipe	Liquid supply valve	On
Suction-type Oil-spray Pipeline	Stop valve of Suction-type Oil-spray Pipe (if any)	On
Liquid-spray Pipeline	Liquid-spray Pipeline Stop Valve (if any)	On
Balance Pipeline	Balance Pipe Stop Valve (if any)	On

Notes: ※ Please refer to the orifice table in container as-built drawing for specific positions of each stop valve.

※※ The setting of safety valve is of great importance. Please check the stability of the safety valve carefully. Refer to [4.4 Notes for Relief Valve]

7.6 Panel setting check

Check if setting values are matched the chiller.

Before chiller start-up, bring panel settings into correspondence with customer system.

Enter “System settings” interface to set parameters (password is requested).

8. Functions of Chiller

8.1 Automatic control of water-temperature for the chillers

The single screw chiller utilizes PID control so that ELWT is automatically close to setting value.

Compressors utilize the stepless control to adapt cooling load change to ensure constant ELWT in a short time.

The logic diagram between ELWT and compressor capacity is shown below:

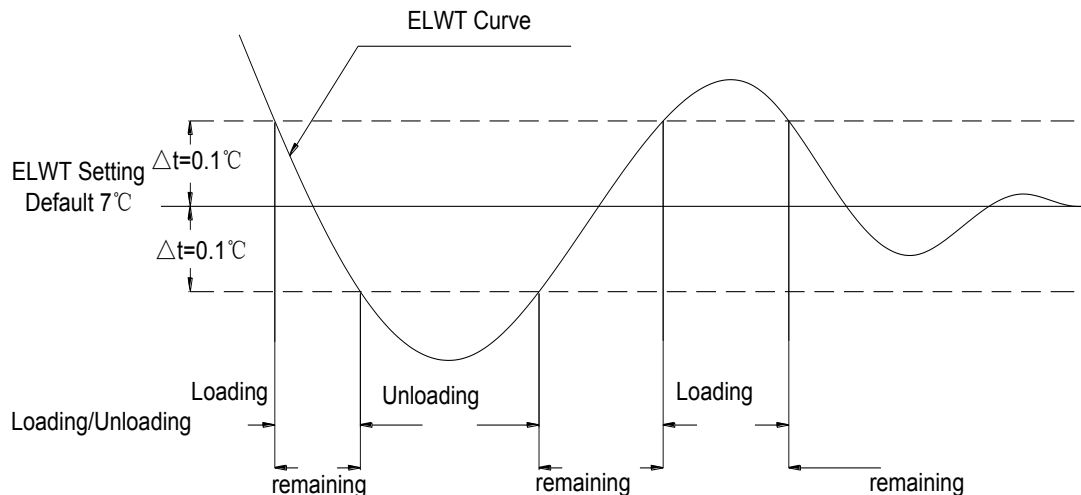


Fig.8-1

Notes:

Cooling condition: the leaving water temperature showing in the figure above is chilled water temperature. The figure above just indicates the chiller capacity control ability along with fluctuation of the chilled outlet-water temperature, and the capacity control may be more complex under the user standard.

Heating condition: the leaving water temperature showing in the figure above is cooling outlet-water temperature. The figure above just indicates the chiller capacity control ability along with fluctuation of the cooling outlet-water temperature, and the capacity control may be more complex under the user standard.

8.2 Chiller capacity control under low cooling load

While the cooling load is below the chiller minimum load, the leaving water temperature of chilled water will fall progressively.

While the water temperature falling to “setting value of the leaving water temp + stop temperature difference”, the chiller will be automatically shut down, while the water temperature rising to “set value of leaving water temperature + stop temperature difference”, the compressor will start to operate automatically again. (The compressor is configured with no re-start function within start/stop time limit)

While the chiller frequently stops at low water temperature, please confirm the items below:

- a. Whether the cooling load falls within the range of capacity control.

Cooling load that is below the chiller minimum capacity will lead to frequent start/stop of the chiller.

- b. Whether there is a proper water flow in the equipment

It will lead to frequent start/stop of the chiller if the equipment water flow is below minimum retention flow. In this circumstance, the “Stop Temperature Difference” can be enlarged (by following “Setting Menu” – “chiller Setting” – “Stop Temperature Difference”)

If the water flow is too smaller, then, enlarging the “Stop Temperature Difference” will be unable to avoid frequent start/stop of the chiller, and the air-conditioning cooling equipment may also be affected in negative way.

Additionally, while there is a bypass circuit on the equipment, please ensure that the water flow in each water circuit is greater than the minimum water flow of the condenser and evaporator. Please refer to [Chiller Parameters Part].

8.3 Limits of Start/Stop

The mounted compressor motor is cooled by refrigerant gas, but frequent startup/shutdown will weaken the cooling effect, then the motor temperature inside compressor will increase too much. Compressor cannot start up within start-stop time limit. If startup command is issued during this period, countdown time will be displayed on HMI.

9. Maintenance

9.1 Regular Maintenance of Protective Device, etc.

Protectors must be checked regularly according to laws and regulations. The process must be recorded at the same time.

Equipment would be damaged by inaccurate operations or incorrect orders

9.2 Pre-maintenance

- a. Contact with other maintenance managers before maintenance.
- b. Make sure that you have read the safety part in **[4.Safety]**.
- c. Please select “Local” on the HMI if you needn’t remote operation to avoid auto-running by remote signals.
- d. Warning signs should be hung in a prominent position when the chiller is being maintained.

9.3 Regular Maintenance

- a. Check the chilled water state.

Change the polluted water in the system if the chilled water quality get worse. Adjust to a correct value if the Ethylene glycol solution concentration reduces below the setting point.

- b. Check that if the air is mixed into the water pipes.

The air may get into the water pipes even though you have vented it at first. Please vent the air at regular intervals.

- c. Clean the inside of Evaporator and Condenser if necessary.

After 2~3 year operating, clean condenser tubes and evaporator tubes once a year is strongly recommended.

You can contact franchiser for more details.

- d. Confirm electrical system

Make sure that there's no loose terminals, no aging and discolored wires.

9.4 Maintenance Contract

The chiller's operation status varies largely with the cooling load, cooling water temperature and flow.

The customer is recommended to sign a maintenance contract with the Daikin service branch.

Please contact with the dealer for detailed information.

9.5 About Refrigerant and refrigeration Oil

The type and charging quantity is shown by chiller nameplate.

Non-designated refrigerant and refrigeration oil is forbidden.

Mixed refrigerant and refrigeration oil is forbidden.

9.6 Routine Maintenance

In order to keep chiller running, regularly maintenance with adjustment and record is required.

Maintenance table is shown in appendix A

See Appendix B for screw chiller maintenance and inspection cycle.

10. Precautions for Long-time Stop

The following shall be done in case of long-time stop:

- a. Shut down stop valve in the liquid supply piping; keep the chiller running until low pressure alarm.
- b. Cut off power, disconnect air switch in control circuit, and press the red emergency switch to prevent oil being heated and chiller being turned on by mistake. Cut off the power supply in case of long-time stop to save electricity and ensure the safety.
- c. Drain and clean heat exchanger when the chiller stops for a long time or the vessels will be rusted, and tubes will be damaged by ice when ambient temperature drops below zero. After the water is drained, please completely clean the internal parts of the chiller to prevent internal corrosion.

Select antifreeze that doesn't react with iron, copper and neoprene.

- Re-operation after long-time stop

Please check the following before re-operation after a long-time stop and contact with the local Daikin service branch.

1. Test insulation resistance before chiller starts. (More than 2 M Ω when test voltage is 380V three-phase AC)
2. Power chiller more than 8 hours before turn it on to heat the oil. [7. Matters to be confirmed before Performing Test Run]

11. Operating range

11.1 Standard Operating Environment

The standard operating environment of the single-screw chiller is as follows:

Voltage:	380V
Voltage fluctuation range:	rated voltage $\pm 10\%$
Phase voltage unbalance rate:	$\pm 2\%$
Frequency:	rated frequency $\pm 2\%$
Operating ambient temperature:	3-40°C (i.e. the ambient temperature of the chiller installation space)
Relative humidity:	$\leq 90\%$, without condensation water.
Altitude:	$< 1000\text{m}$ (When star delta starter device adopted, the max altitude height allowed is 2000m. Ultrahigh altitude will influence the electrical insulation and electric conductivity and measures shall be taken to protect the chiller)
Explosion-proof grade:	None
Pollution grade:	3

The corrosive gas composition in the atmosphere:

Concentrations of sulfur dioxide:	$\leq 10 \text{ mg/m}^3$
Concentrations of Hydrogen fluoride:	$\leq 5 \text{ mg/m}^3$
Concentrations of Hydrogen sulfide:	$\leq 5 \text{ mg/m}^3$
Concentrations of Nitrogen oxide:	$\leq 5 \text{ mg/m}^3$
Concentrations of Chloride:	$\leq 1 \text{ mg/m}^3$
Concentrations of Hydrogen chloride:	$\leq 5 \text{ mg/m}^3$

Installation: indoor installation without direct exposure to the rain and the sun (if it shall be installed outdoor or in the such atmospheric environments with high concentration of corrosive gas as seaside or chemical plant, please contact the local Daikin branch office and dealers)

11.2 Minimum Retaining Water Capacity of System

The minimum retaining water of chilled water system shall be larger than 5360L (under GB conditions) to prevent the frequent start and stop of the chiller. Please refer to 6.2 *Piping Engineering*, if the working conditions of customer are different from the GB conditions.

11.3 Water Quality for chiller

The quality of chilled water and cooling water has direct impact on the performance and service life of the chiller. Thus, the water quality shall be investigated in advance, and the management of water quality shall be valued.

Notes: The water evaporation makes the open-type circulating water concentrate.

See water quality indexes in the following table:

Item		Chiller	Baseline Value	Item	
				Corrosion	Scaling
Baseline Items	pH(25°C)	—	6.5-8.0	O	O
	Electrical Conductivity(25°C)	μS/cm	<800	O	O
	Chloride Ion Cl^-	mg(Cl^-)/L	<200	O	
	Sulfate Ion SO_4^{2-}	mg SO_4^{2-} /L	<200	O	
	Acid Consumption (pH=4.8)	mg(CaCO_3)/L	<100		O
	Total Harness	mg(CaCO_3)/L	<200		O
Reference Items	Ferrum Fe	mg(Fe)/L	<1.0	O	O
	Sulphion S^{2-}	mg(S^{2-})/L	Not Detected	O	
	Ammonium Ion NH^+	mg(NH^+)/L	<1.0	O	
	Silicon Oxide SiO_2	mg(SiO_2)/L	<50		O

Notes:

1. water quality requirement refers to GB/T18430.1-2007 *Water chilling(heat pump) packages using the vapor compression cycle—Part 1:Water chilling (heat pump) packages for industrial & commercial and similar application*, appendix D cooling water quality.
2. Sign “O” shows possible harmfulness of corrosion and fouling.
3. If water quality can't meet the requirements showed above, please handle the water according to GB50050-2007 *Code for design of industrial recirculating cooling water treatment*

We recommend you add water process device and contact Daikin professional servicer to deal with it.

Appendix A

	8:00	10:00	12:00	14:00	16:00	18:00	20:00
Condenser/ Heat Recoverer							
Condensing pressure (kPa)							
Entering water temperature(°C)							
Leaving water temperature(°C)							
Enter/Leaving water pressure drop(kPa)							
Evaporator							
Entering water temperature °C)							
Leaving water temperature(°C)							
Enter/Leaving water pressure drop(kPa)							
Entering water temperature °C)							
Others							
Discharge temperature(°C)							
Supply oil pressure(kPa)							
Oil separator level visible or not							
1# compressor capacity							
2# compressor capacity							
Chiller's Power							
Chiller's current							
Check for bubbles or not in the liquid line sight glass							

Appendix B

Interval Items			3 Month s	6 Month s	1 Year	2 Years	3 Years	4 Years Later	5 Years Later	6 Years Later	7 Years Later	8 Years Later	9 Years Later	10 Years Later	11 Years Later	12 Years Later	13 Years Later	14 Years Later	15 Years Later	Replacing criteria when abnormal
		Start		2500	5000	8000	20000				40000									
Daily Inspection		1. suction and discharge pressure 2. Oil level (check the oil quantity through Oil sight glass) 3. Sound (any abnormal sound exists) 4. Check the motor overload protector (trip or not, reset if any and check the reason of trip) 5. Discharge superheat degree of compressor (The discharge superheat of R22 chiller shall be larger than 10 °C; the discharge superheat of R134a chiller shall be larger than 5°C and the discharge superheat of R410A chiller shall be larger than 7 °C)																		
Monthly Inspection		1. Color of compressor oil (new oil is clean and the dark brown or cloudy oil shall be replaced; the compressor shall be overhauled when the oil turns dark) 2. Check the color of the sight glass on the liquid supply pipe (yellow indicates that the water content of refrigerant is out of limits; Heating : the liquid supply pipe is filled with refrigerant liquid and has no bubble , Cooling: there has no bubble or little bubble at the normal condition) 3. Check any leakage of the refrigerant circuit (check any oil strain or leakage around the pipeline) 4. Check the differential oil pressure (The difference between high pressure and oil pressure shall not exceed 1.5 bar during operation, or the oil filter shall be replaced)																		
Compressor	Bearing (screw)					○		○			▲			○		○			▲	Running abnormal (sound, vibration) or Small fragments detected when checking; replace seal assembly
	Bearing (Star wheel)					○		○			▲			○		○			▲	
	Body					○		○			○			○		○			○	Check the debris, cracks or similar phenomena found
	Screw rotor					○		○			○			○		○			○	

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	Motor			○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▲	Abnormal insulation resistance is detected
	Injection expansion valve						○	○	○	○	▲	○	○	○	○	○	○	○	▲	Abnormal operation is detected
	Electric expansion valve(capacity control)	○					○	○	○	○	▲	○	○	○	○	○	○	○	▲	Abnormal insulation resistance is detected
	Oil filter	○	○	○	○	▲	○	○	○	○	▲	○	○	○	○	○	○	○	▲	The pressure difference exceeds 1.5 bar during operation
	Discharge valve						○	○	○	○	▲	○	○	○	○	○	○	○	▲	There are sounds of gas reflux or fast pressure balance after the running has stopped, The valve has abnormal noise regularly during the running of chiller.

	lubricant oil	○	○	○	○	▲	○	○	○	○	○	▲	○	○	○	▲	○	○	○	▲	Obvious black suspended substance, floc and oil sludge, acidity>0.04 (mg KOH/g), water content >400 ppm
Heat exchanger	Cleaning tubes: physical or Chemical			○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▲	Heat transfer temperature difference more than 3 °C
	Water pressure drop(see chiller specs)	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		To check whether the rubber gaskets are damaged if the pressure drop value is lower than 60% Rating values
Valves	Expansion valve (cannot control the liquid supply volume and liquid level)	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	▲	Turn up the valve and the liquid level of condenser does not decline significantly and the low pressure has no upward tendency.

SINGLE SCREW CHILLERS IMM

	Solenoid valve (abnormal open or close)	○		○	○	○	○	○	○	○	▲	○	○	○	○	○	○	○	▲	No flowing fluid during starting or fluid flows during closing the chiller
control	controller	○		○	○	○	○	○	○	○	▲	○	○	○	○	○	○	○	▲	The input or output of signal is abnormal
	Fuse	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Disconnection
	Contactor				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Contact electric corrosion or noise are detected during the running
	Sensor				○	○	○	○	○	○	▲	○	○	○	○	○	○	○	▲	The measured value after calibration deviates the actual value (pressure 10kPa and temperature 1 °C)
	Auxiliary relay	○		○	○	○	○	○	▲	○	○	○	○	▲	○	○	○	○	▲	Abnormal operation is detected

	Time relay	○		○	○	○	○	○	▲	○	○	○	○	▲	○	○	○	○	▲	Abnormal operation is detected, Timing deviation exceeds the maximum range of 10%
	High voltage switches				○	▲	○	○	○	○	○	○	○	○	○	○	○	○	▲	The cut-off value exceeds the calibration value (+0.05, -0.08)
	Low voltage switches				○	▲	○	○	○	○	○	○	○	○	○	○	○	○	▲	The cut-off value exceeds the calibration value (+0.05, -0.03)
	Wiring for loose contacts (Retighten if any)	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
Others	Check Power supply	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Power supply voltage exceeds the range of $\pm 10\%$ of rated voltage, phase unbalance $\geq 2\%$
	Check water quality (dirt, impurity)	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	Check as GB standard
	filter (Water suction conditions)	○	○	○	○	○	▲	○	○	○	▲	○	○	○	▲	○	○	○	▲	The sight glass indicate yellow

Notes:

1. ○: Check at intervals as specified and replace when the component is abnormal and the replacing standard is met.
▲: Recommended clean and replace cycle.
2. The components shall be replaced as per the interval and operating time, whichever is earlier.
3. Customer shall check and record the items on daily and monthly basis and other inspection items must be executed by Daikin professionals.
4. Please refer to GB18430.1-2007 for water quality and it is recommended to add water treatment devices and contact with Daikin professionals in case of poor water quality.

Appendix C

(Informative Appendix)

Instructions for Flow Switches

1. Dimension of Flow Switches

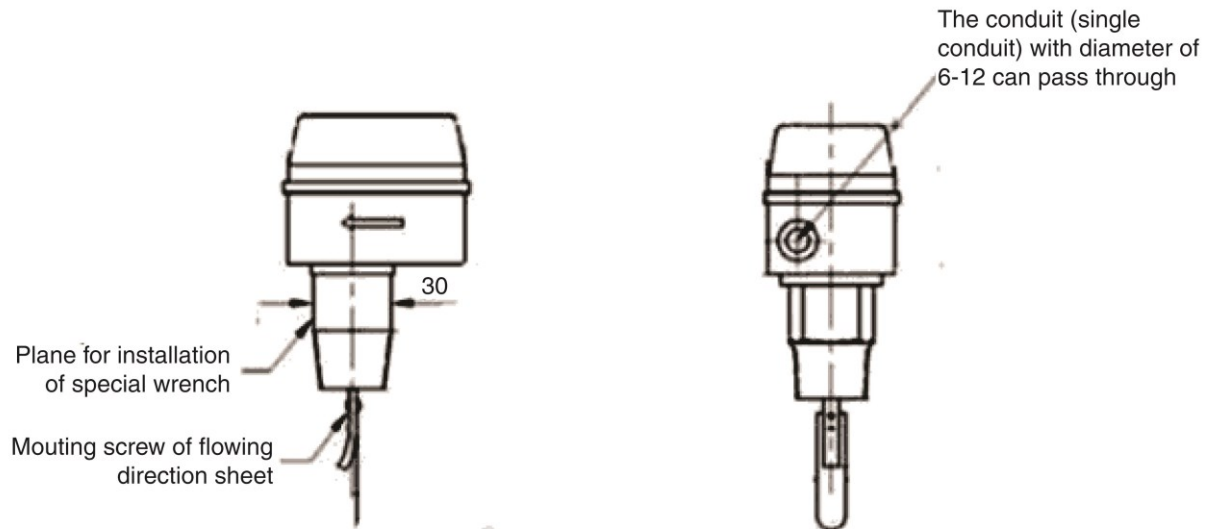


Fig.1 Dimension

2. Operating Conditions of Flow Switches

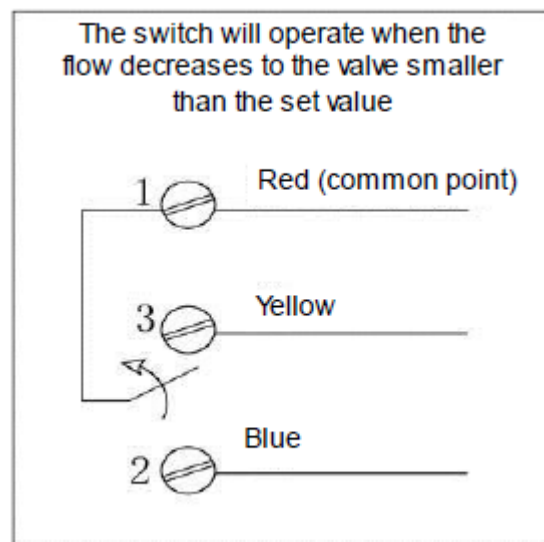


Fig.2 Switches Motion

When sufficient liquid passes through the pipe and turns the flow switch on, the circuit between red to yellow points is connected.

3. Flowing direction sheet

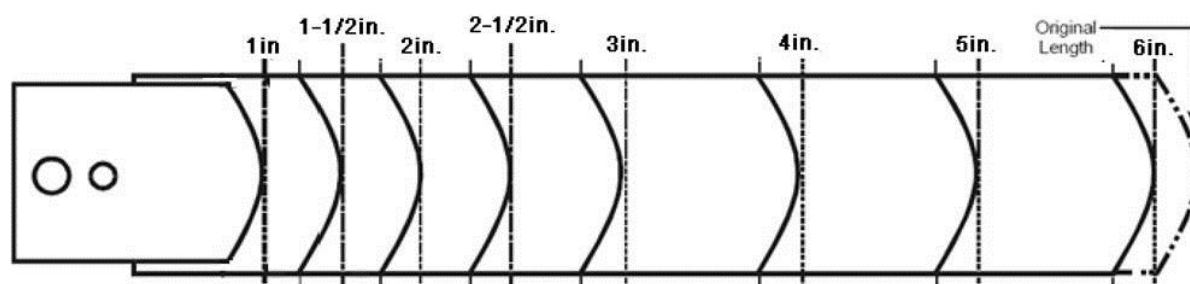


Fig.3 Trimming Template Sketch Map of Flowing Direction Sheet

Fig.3 is a trimming template sketch map and please refers to the trimming template of flow switch during the practical operation.

User can install the removable flowing direction sheet 1, 2, 3 and 6 of flow switches allocated by the factory according to actual needs. If flowing direction sheets of other dimensions are needed, trim the flowing direction sheet based on the template and match its arc shape with the pipeline. For instance: as shown in Fig.4, flowing direction sheet 1, 2 and 3 can be installed for the 3" pipeline. Flowing direction sheet 2 shall be trimmed to the proper length as per the template when 1-1/2" pipeline is used. In addition to installing flowing direction sheet 1, 2 and 3, flowing direction sheet 6 shall be trimmed to the proper size according to the *Inside Diameter Flowing Direction Sheet Template of Corresponding Pipeline* and used for the installation of 4", 5" and 6" pipelines. Flowing direction sheet 1, 2, 3, and 6 shall be installed on the 8" pipeline. The correct installation positions are shown in the Fig.4.

Notes: The flowing direction sheet shall not contact with the pipeline and any throttling device in the pipe so that the switch can induce the flow rate variation.

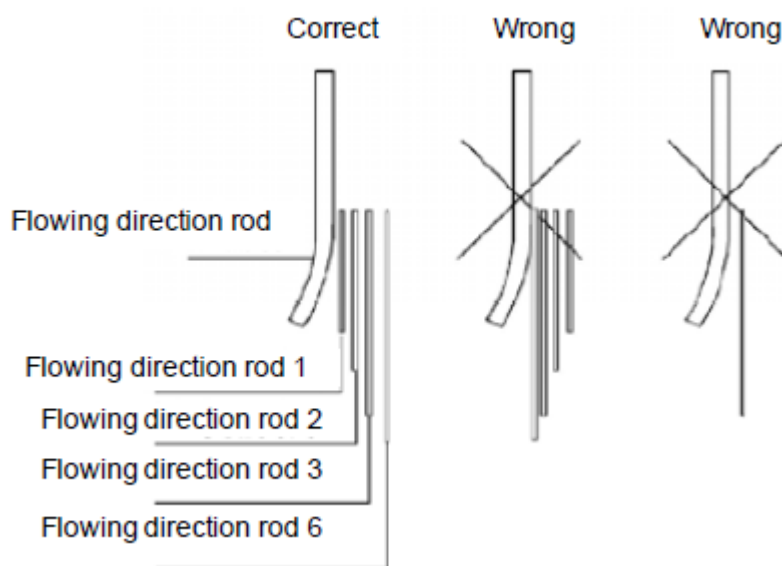


Fig.4

4. Installation Requirements

- 4.1 The flow switches must be installed on the straight pipeline with at least straight stroke of 5 times of the pipe diameter on both sides (as shown in Fig.5). The connecting terminals shall be installed on the position available for connection during the installation of switches.

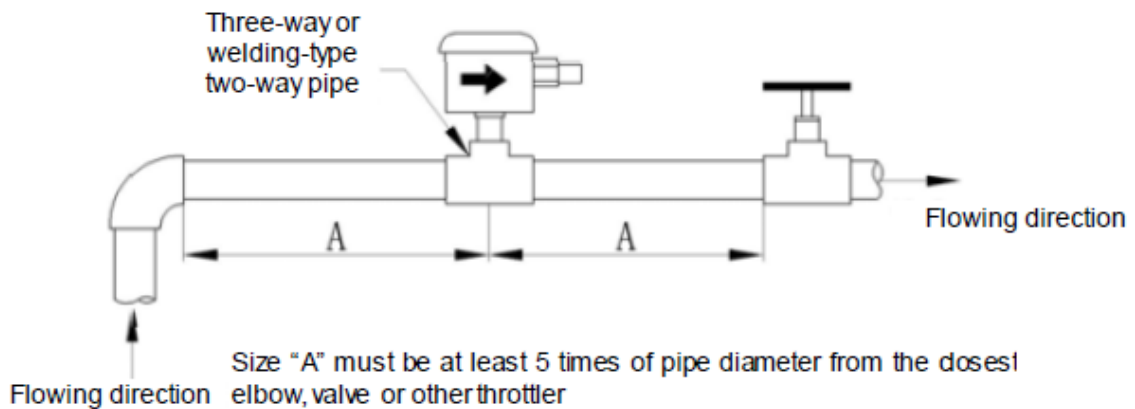


Fig.5

- 4.2 The flow switch shall be installed in the horizontal pipeline or vertical pipeline in the direction of liquid flows other than the pipeline of downward direction of liquid flows. If it has been installed in the pipeline in upward direction of liquid flows, the gravity effect shall be taken into account to adjust the values higher slightly than the typical flow values in the Table 1.

Table 1 Typical Flow Value (Take Fengshen FSF50P-1 as an example)

Pipeline Size	Target Slice Size	Flow <m ³ /h>		Remarks
		Min. Disconnection	Max. Disconnection	
φ168	6"	24	72	Target slices of 1", 2", 3" and 6" shall be installed
φ219	6"	48.4	174	Target slices of 1", 2", 3" and 6" shall be installed
φ273	6"	43	90	Target slices of 1", 2", 3" and 6" shall be installed

Example: the size of connection pipe for chiller is φ168 with the min. flow of 32.5 m³/h; According to the examination of the table above, when the cut-off value is between the min. and max. cut-off values, the cut-off value of water flow shall be adjusted to the nearly min. water flow through adjusting the screw based on the methods below.

- 4.3 Special wrench must be used to connect the three-way connector on the hexagonal panel of switch connector and the switch casing cannot be held for connection so as to prevent damage.
- 4.4 The projection plane of flowing direction sheet shall be perpendicular to the fluid direction, and the direction of the arrow on the switch casing shall be in line with the fluid direction when the flow switch is screwed into the three-way connector.

Notes: The flow switches shall not suffer water hammer, proper throttle must be used if the rapid closing valve is installed in the downstream of the flow switch.

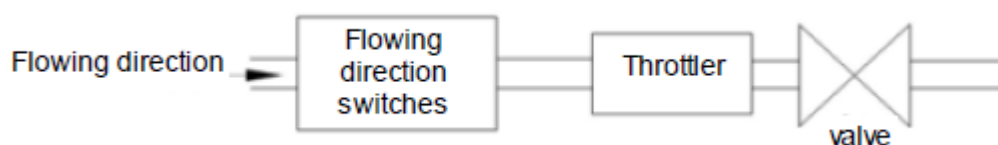
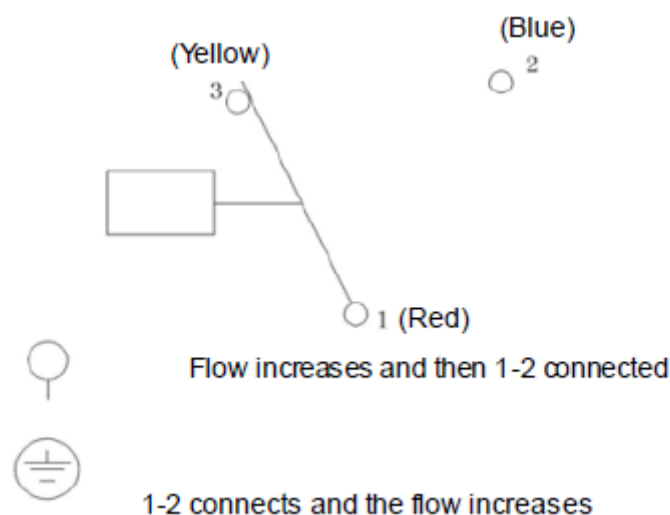


Fig.6 Installation Diagram of Throttler

5. Switch Adjustment

The procedures for setting adjusting flow switches:

- Remove the casing of flow switches:
- Turn up the flow and rotate the adjusting screw in clockwise direction. After turning up the ex-factory set value, rotate the adjusting screw in counterclockwise direction to turn down the flow value (as shown in Fig.1).
- Press the driving lever for times to ensure that the set value of the flow switch is no less than ex-factory set value. If the driving lever returns without “click” sound, rotate the screw in clockwise direction until the driving lever makes such sound.



Notes: Incorrect operation is dangerous.[⚠]



The ex-factory set value is nearly the min. flow value (see Table 1). The value shall not be adjusted to the value lower than the ex-factory set value to ensure that the switch can return to the position of “No Liquid Flow”.[⚠]

Notes: Equipment Damage Danger![⚠]



The set point of paint sealing (the screw with paint) cannot be adjusted optionally, or the control will be damaged and the adjustment will be failed, and it is out of the warranty scope.[⚠]

6. Check Procedures

When sufficient liquid flows through the pipeline, the flow switch actuates and the circuit between red and yellow contact points connects.

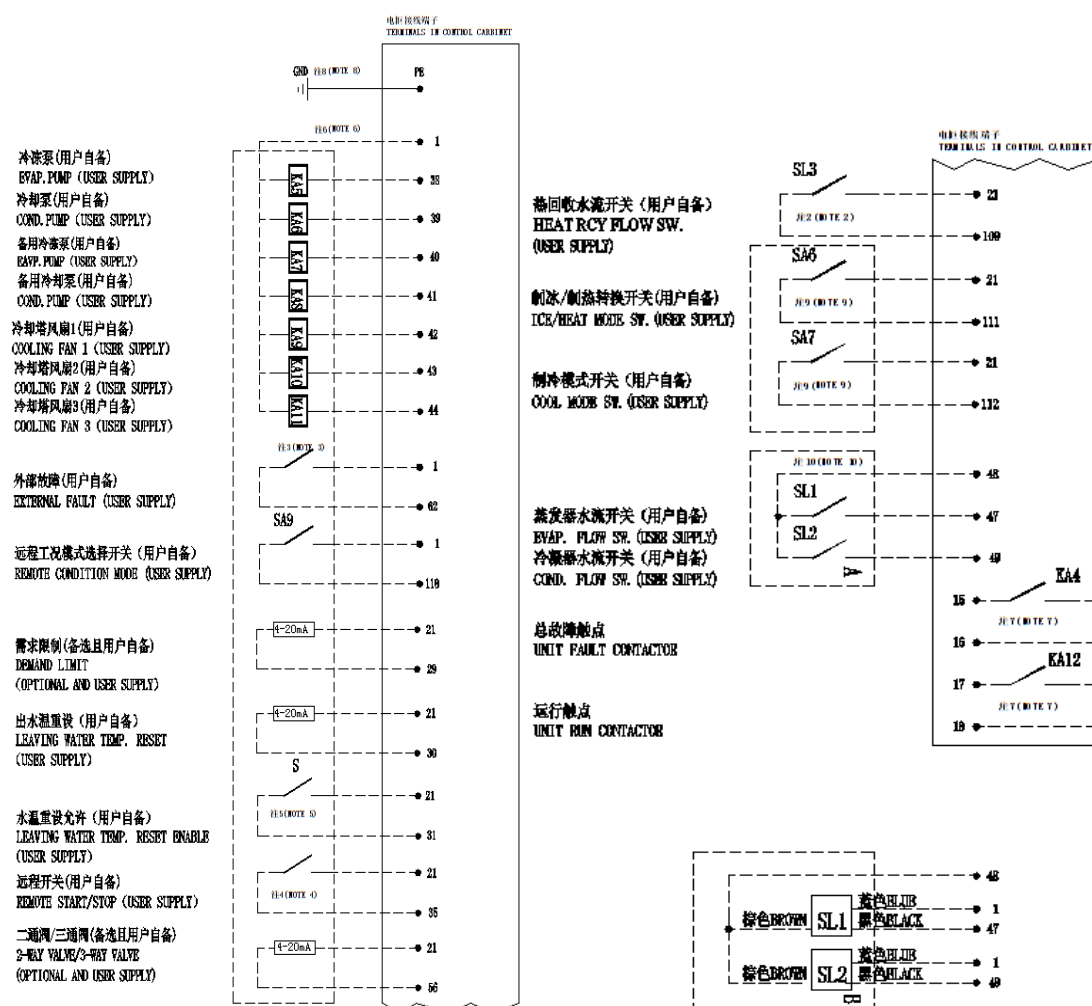
At least three operating periods shall be observed to ensure the normal operation of the flow switches and the connected system before the installation is complete.

7. Fault Elimination

Phenomena or Problems	Solutions
The bellows is damaged and the liquid leaks into the casing.	Replacement
Scraps have stuck the mechanical parts of switches tightly.	Clear the scraps in the mechanical parts and test for several times to ensure its normal operation.
Reverse the motion of control switches	Check the wiring connection based on the wiring diagram
The control switch fails to actuate	Check the wiring and check whether the flowing direction sheet has contacted with the pipeline
The switch actuates when liquid flows and does not reset without liquid flow.	The direction of liquid flow shall be in line with the direction of arrow and the liquid shall flow upward in the vertical pipeline
The switch fails to actuate when the flow increases	Check whether there are cracks or fractures, if any, replace the sheet.
HMI shows phase alarm	Verify line voltage within 90% -110% of rated voltage. Then, phase sequence protection alarm can be reset by manually rebooting the cabinet.

Appendix D

Field Wiring Diagram of Control cable



Note:

1. This drawing has DC wires and 220VAC wires; it is recommended that DC wires be run separately from 220VAC wires.
2. Only heat Recovery Unit need to connect this signal.
3. If users order the External Fault Output function, users need to supply an alarm signal, connect the NO contactor of the alarm relay between No. 1 and No. 62 terminals.
4. If users order the Remote Start/ Stop function, connect a switch (user supply) between No. 21 and No.35 terminals can realize the function.
5. If users order the Leaving Water Temp. Reset function, connect a switch (user supply) between No. 21 and No.31 terminals can realize leaving water temperature reset enable function.
6. If users need to control evap. pumps, cond. pumps and cooling fans, connect the coils of 220VAC relays (user supply) to the corresponding terminals, using the contactors of those relays to control the pumps and the fans.
7. If users order the Unit Fault Output function, the cabinet supplies a passive contactor between No. 15 and No.16 terminals. If users order the Unit Run Output

function, the cabinet supplies a passive contactor between No. 17 and No.18 terminals.

8. Users need to connect the grounding bus bar of the cabinet to the ground.
 9. If users order the Ice/ Heat function, connect the switch (user supply) to the corresponding terminals to switch the modes.
 10. According to the users' order, when the flow switch is target type, according to the dashed box A, when the flow switch is thermal type, according to the dashed box B.
-

Service Procedure

The schedule maintenance for AC system can prolong its lifespan and keep high efficiency performance.

Since the chiller starts, the maintenance is basically required. 3 to 4 weeks after the first start-up, it must be overall inspected, followed by to periodically maintenance.

DAIKIN provides diversified maintenance service according to different client's needs.

Contact

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