

Installation Operation and Maintenance Manual

IOMM HXE

Group: Magnetic Bearing
Centrifugal Chillers

Date: Mar. 2023

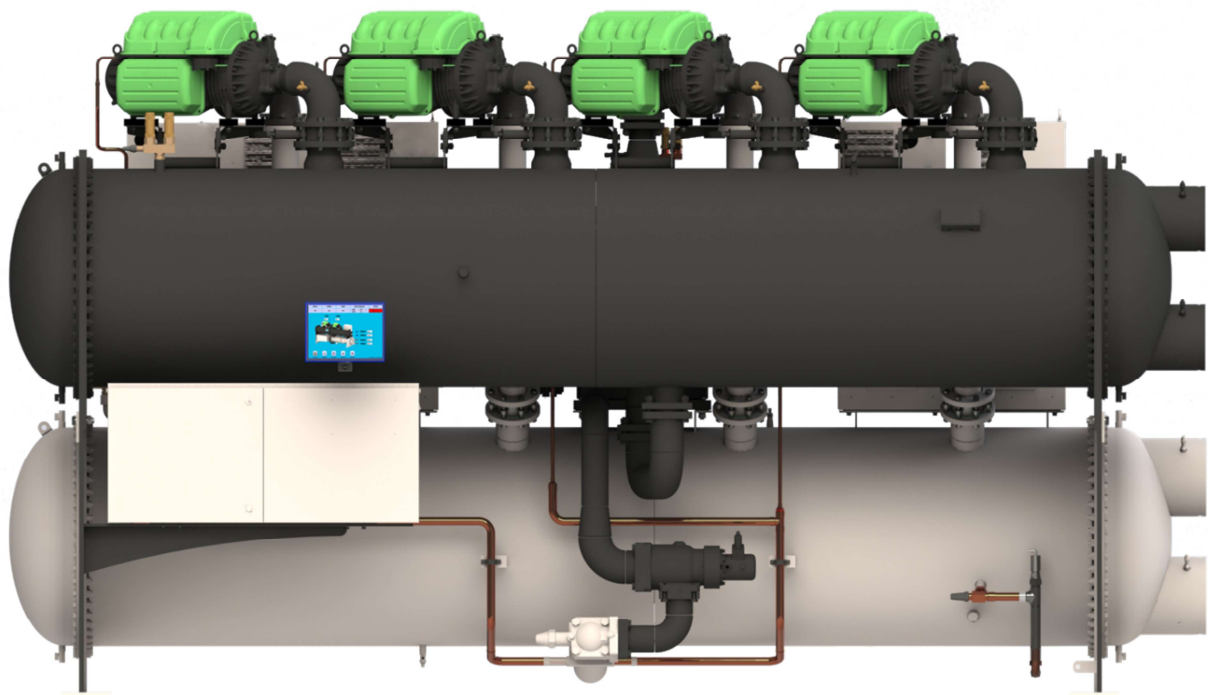
New part No.: Z8100390-03

Old Part No.: Z8100390-02

Magnetic Bearing Centrifugal Chiller

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

HXE (Using TGS Compressors)



Thanks for purchasing DAIKIN chiller.

The Manual specifies safety, installation and maintenance precautions.

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

Engineered for Flexibility and Performance



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1.Introduction

1.1General

Basing on matching with an optimized refrigerating system, the Magnetic Bearing Compressor Chiller is utilized an advanced automatic control system to accurately control each procedure in the running process. Besides, it features an oil-free operation so to maintain the chiller be always in the optimum running state.

Considering the different climates in different areas and also the customers' different requirements on the operation status of each chiller, the Company offers water chillers of different models and different specifications to satisfy customer's requirements on the chillers.

HXE chillers are designed for single compressor or multi compressors. Both of them have one condenser and evaporator.

The standard chiller adopts the R1234ze(E) refrigerant as a green and environment-friendly refrigerant. The standard water chiller runs at normal pressure, so the purity is ensured, the utilization rate of the refrigerant is improved, the running stability is also improved, and the dimension and weight are reduced.

1.2Refrigerant Introduction

Refrigerant type: R1234ze(E)

Global Warming Potential GWP: 1

For further details on physical properties, flammability & toxicity characteristics, hazards Identification, installation safety requirements, etc, refer to standards ,such as:

- **ASHRAE 34, EN 378, ISO-817 and ISO-5149**

According to ISO-817, R1234ze(E) is classified in safety group A2L: lower flammability. One of the characteristic of this refrigerant is the absence of flammable mixture with air under 21°C of ambience and controlled humidity conditions. However when humidity or temperature goes up, this refrigerant can become flammable and can represent a potential danger if flammability risks are not properly mitigated within the machine room installation.

1.3Application

The installation, operation and maintenance procedures are applicable to HXE series chillers. If any change is required to the structure and installation of chiller, please be sure to contact DAIKIN for inquiry.

Always ensure that all required safety measures are followed, including those in this document, such as: wearing protective clothing (gloves, safety glasses and shoes) using appropriate tools, employing qualified and skilled technicians (electricians, refrigeration engineers) fully trained in the use of flammable refrigerants and following local regulations (see annexed E in EN 378 -4- Guidelines for repairs of equipment using flammable refrigerants).

Before shipping, all DAIKIN centrifugal water chillers have been performed with ex-factory test. The first commissioning on the customer site must be completed by the DAIKIN authorized technical service personnel, or else, the caused damage will not belong to the warranty range.

The warranty covers the parts certified to be caused by material defect or be the inferior product manufactured by the plant. For the details about the warranty, see the accompanying Warranty or the final party of this Manual.

1.4 Nomenclature

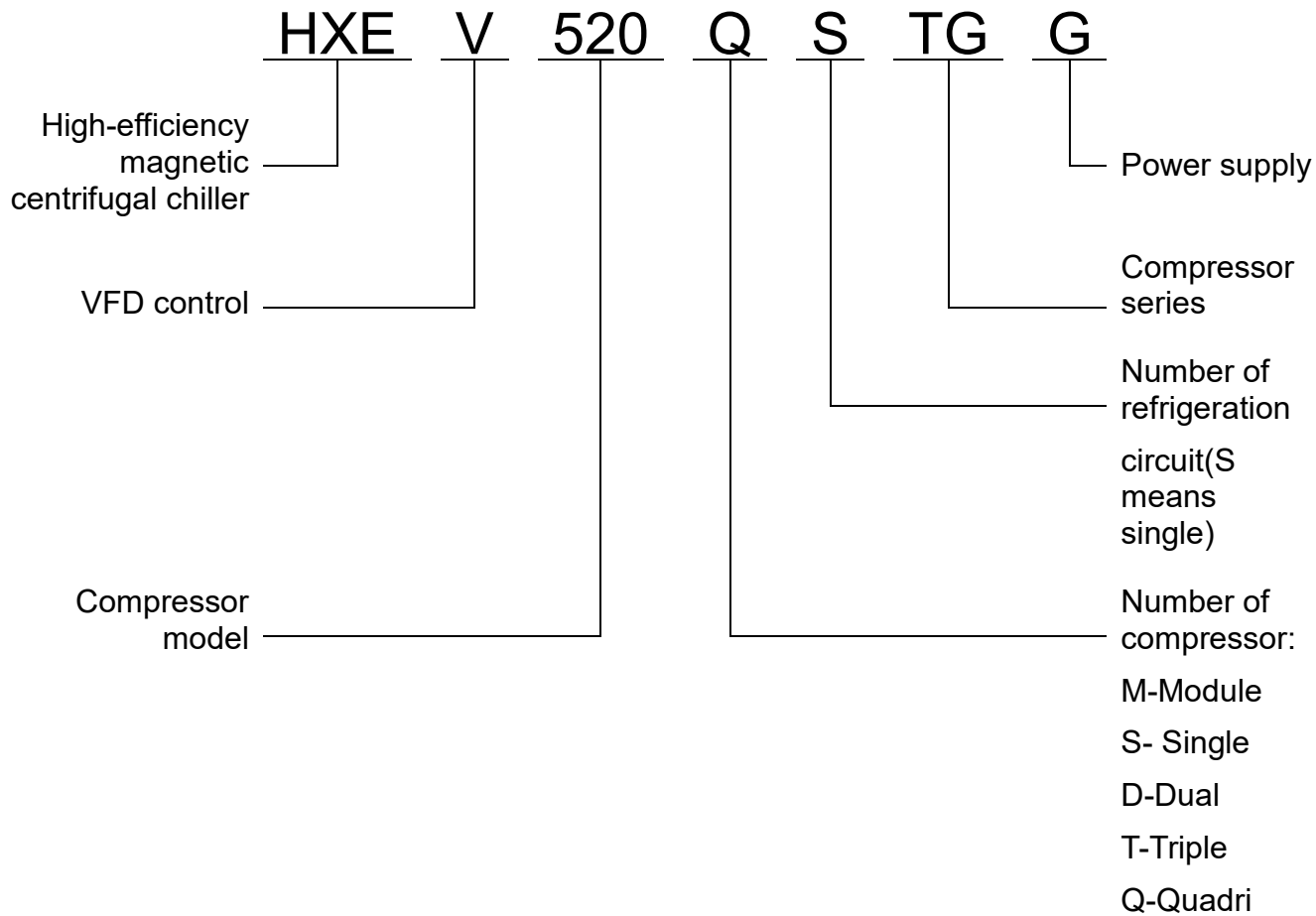


Fig. 1-1

Note: For convenience, use HXEM(S)/HXED/HXET/HXEQ to nomenclature HXE chiller with different number of compressors.

2. Major Component Locations

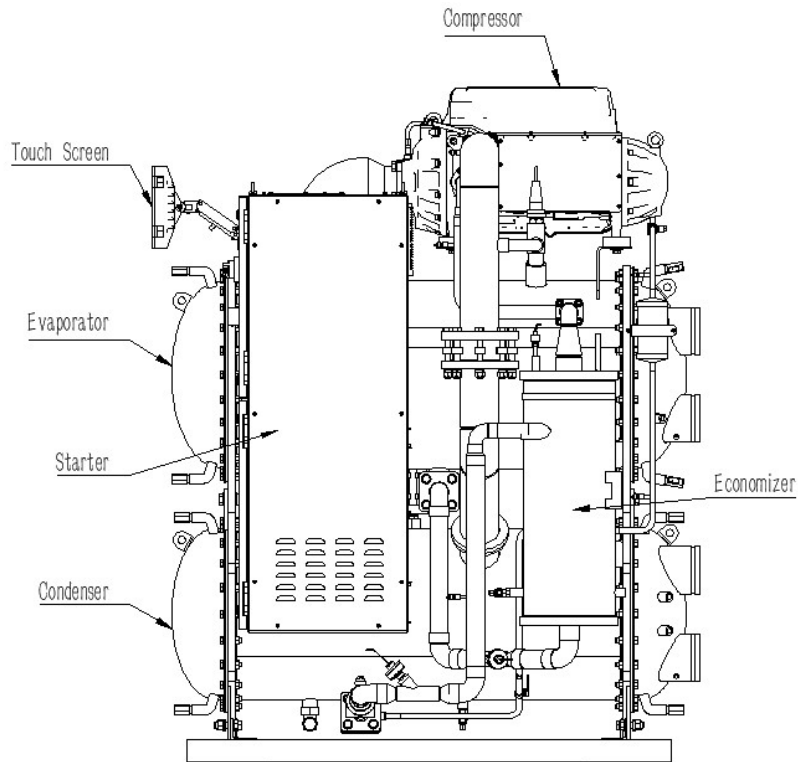


Fig.2-1 HXEM chiller side view (single module chiller)

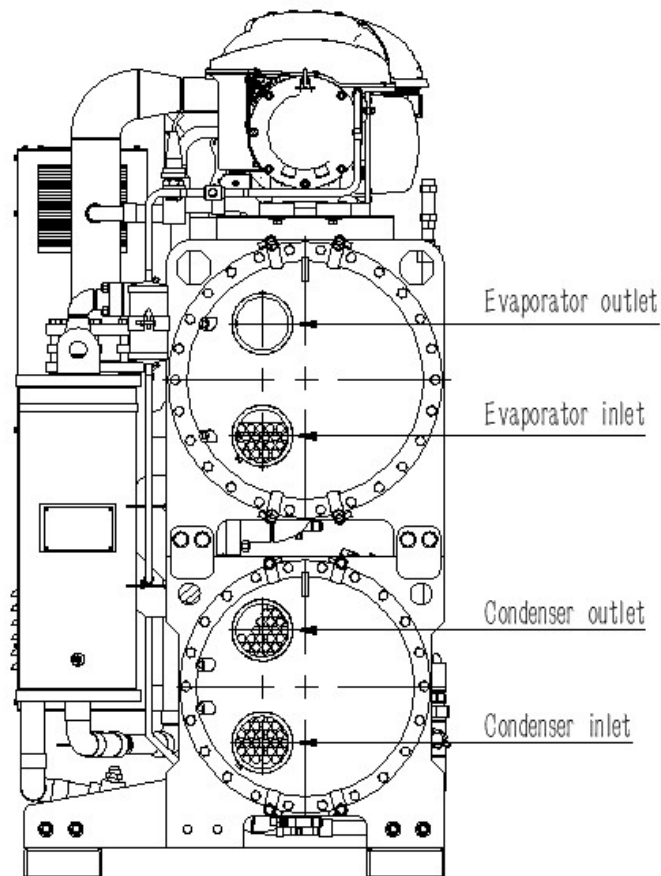


Fig.2-2 HXEM chiller side view (single module chiller)

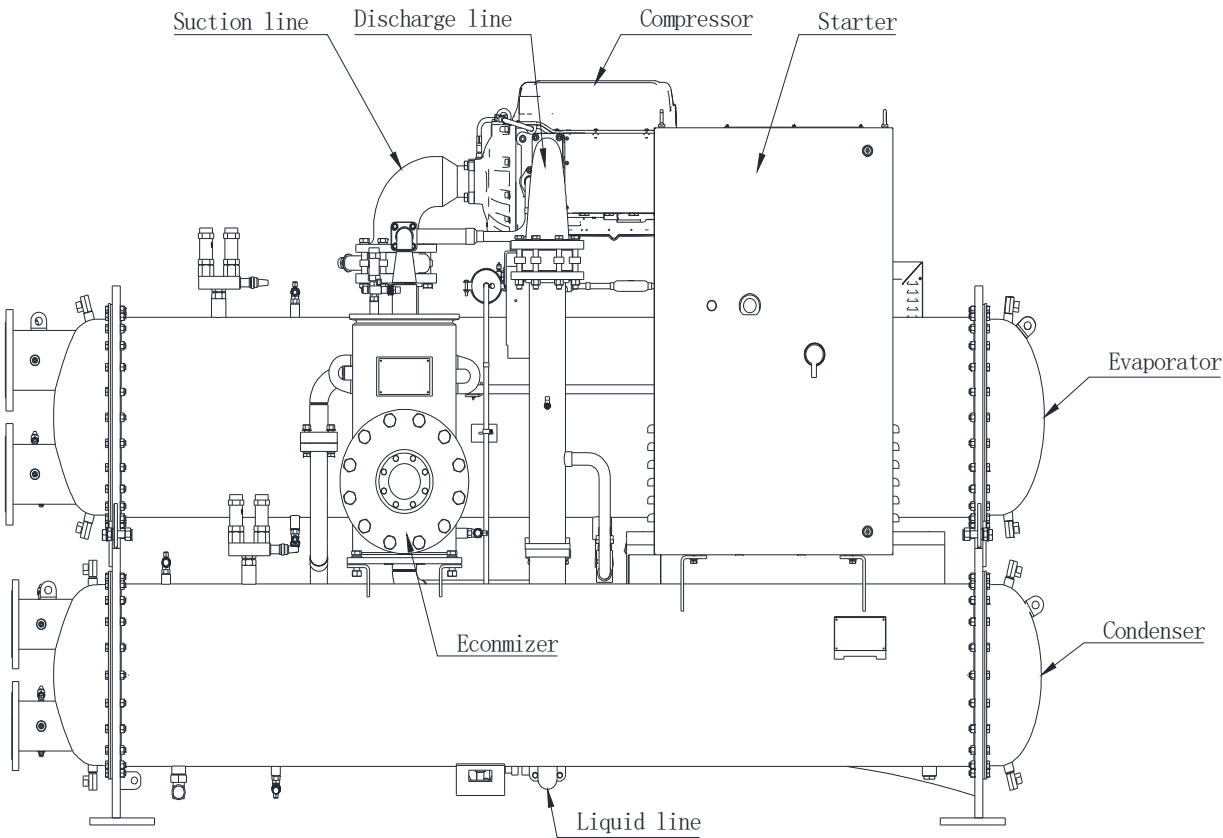


Fig. 2-3 HXES chiller vertical view

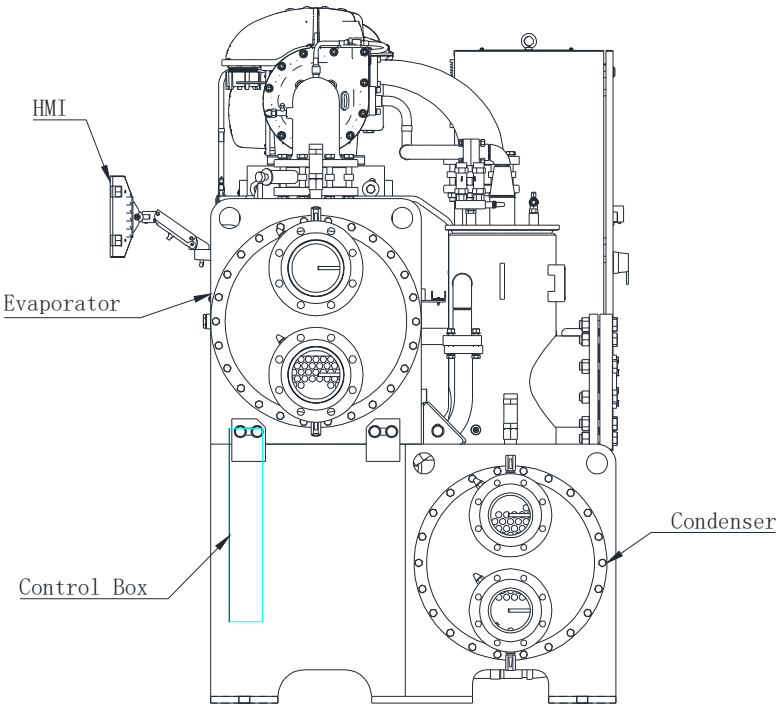


Fig. 2-4 HXES chiller side view

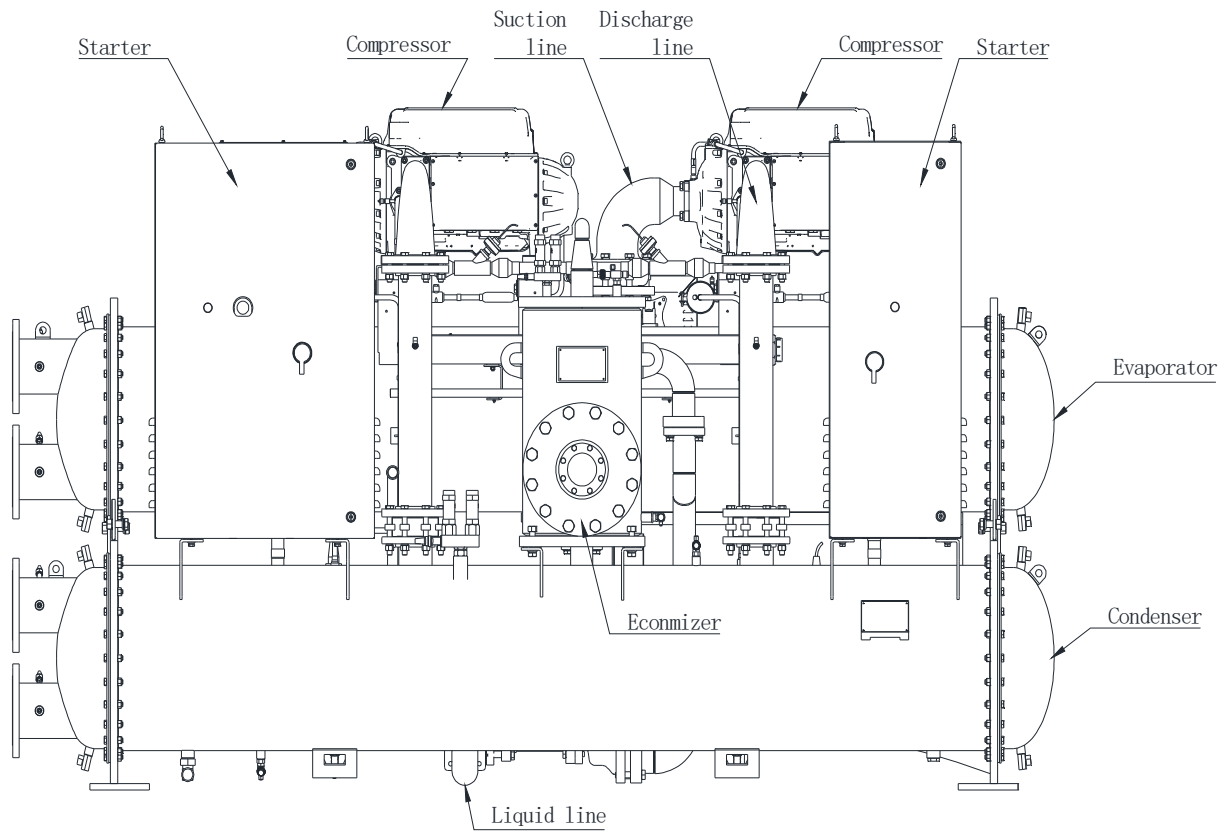


Fig. 2-5 HXED chiller front view

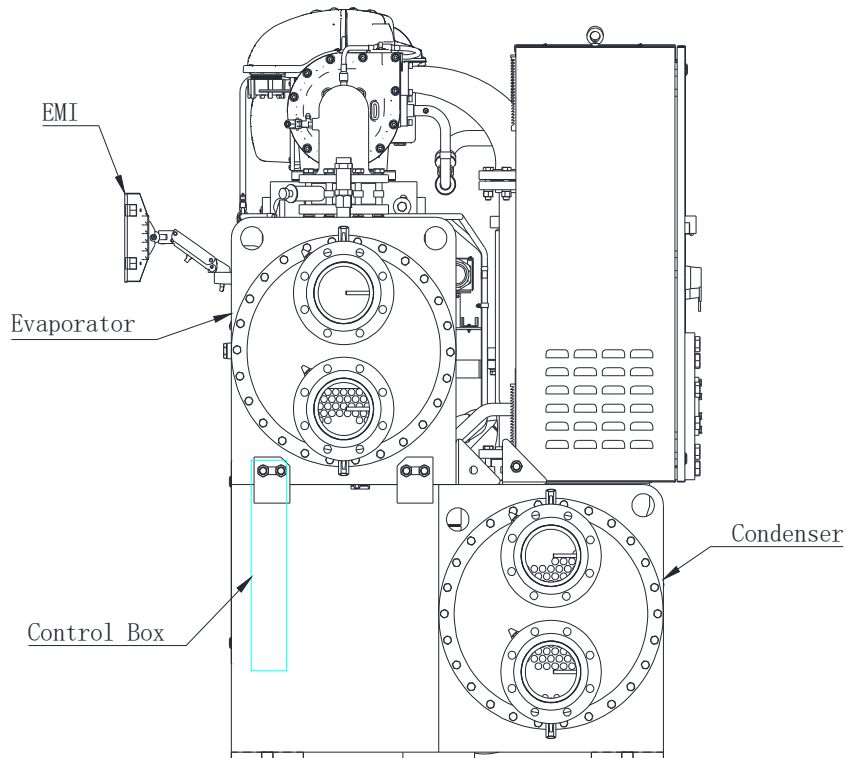


Fig. 2-6 HXED chiller side view

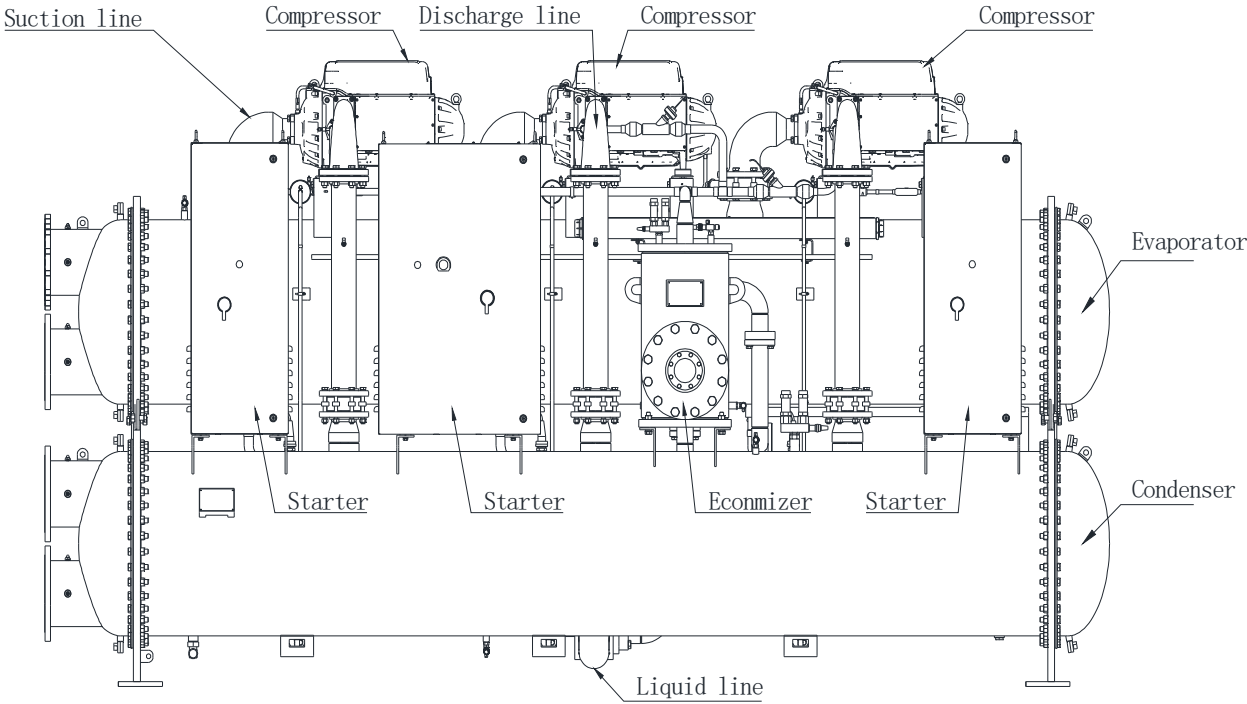


Fig. 2-7 HXET chiller side view

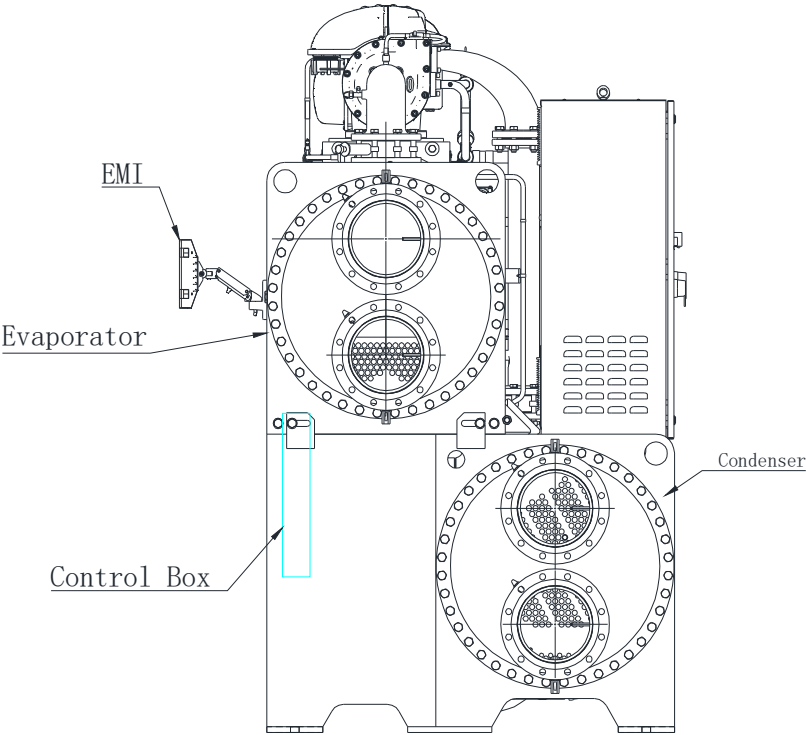


Fig. 2-8 HXET chiller side view

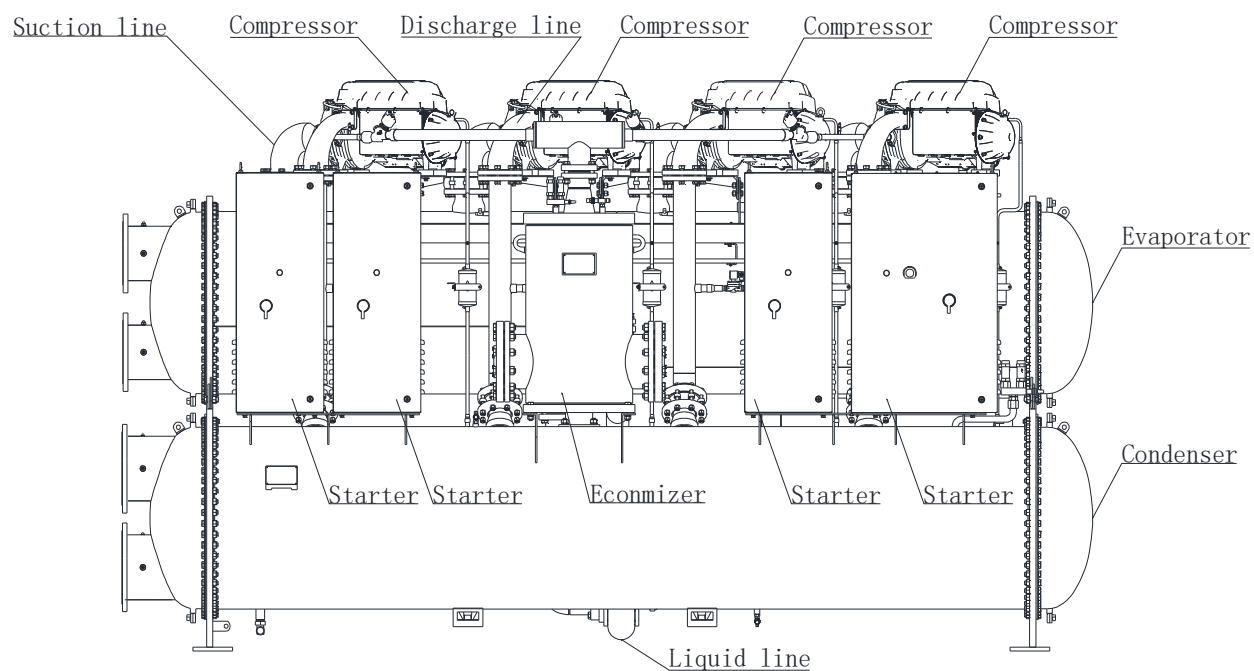


Fig. 2-9 HXEQ chiller side view

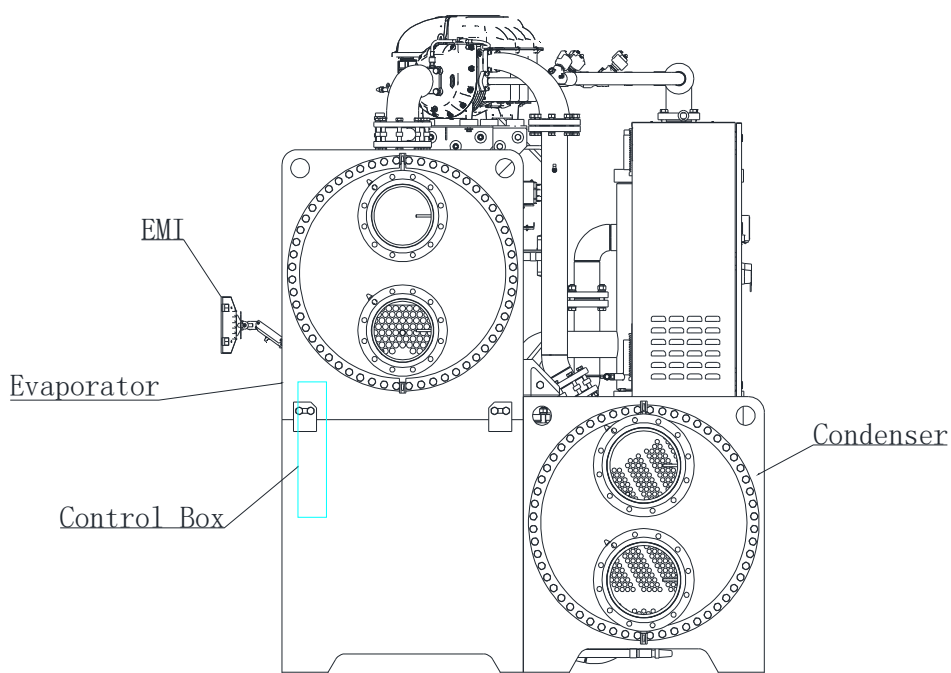


Fig. 2-10 HXEQ chiller side view

The appearance dimension is different for different type, and the water connecting pipe direction in above figure is only for standard chiller.

For the details about the appearance, please see the appearance figure.

3.Working Principle And Technical Data

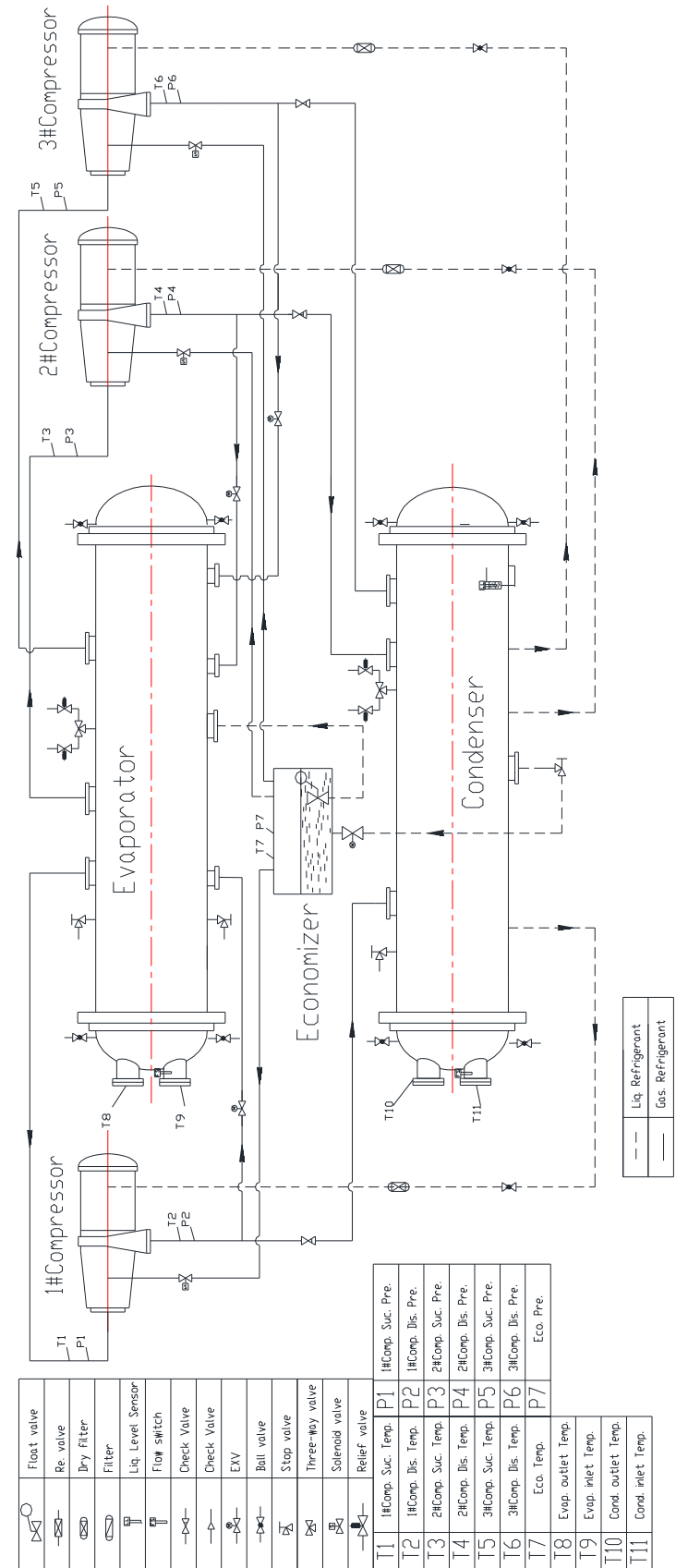


Fig. 3-1 working principle of HXE chiller

3.1 Working Principle

Take HXET chiller as the example. Chiller equipped with flash tank as economizer is more efficient than PHE economizer. The working principle is showed as figure 3-1:

1. The low-temperature and low-pressure refrigerant enters the compressor and becomes a high-temperature and high-pressure gas after compressed, then enters the condenser from compressor, and exchanges the heat with cooling water in the condenser.
2. The high-pressure liquid refrigerant after cooled by the condenser is throttled down in the electronic expansion valve, and then enter the economizer.
3. Some of the refrigerant is flashed in economizer and then enter the compressors. The liquid refrigerant is throttled by float valve, and then enters the evaporator.
4. The refrigerant is evaporated in the evaporator and takes use of latent heat to make the chilled water temperature decrease and thus achieve cooling.
5. The refrigerant gas enters the compressor and begins the next cycle.
6. HXET chiller has the same working principle as HXEQ chiller. The only difference is the quantity of compressors.

3.2 Major Components

Evaporator

Refrigerant-side design pressure is 1,400kPa, and Water-side is 1,000kPa. The physical parameters of the evaporator are shown as below:

Table 3-1

Evaporator Code	Tube Length(ft)	Refrigerant Charge (kg)	Evaporator Water Volume (L)	Number of Relief Valves
E2203-SL	03	70	110	2
E2204-SL	04	88	115	2
E2209-PH	09	132.3	342	2
E2209-QH	09	129.0	301	2
E2209-RH	09	128.1	211	2
E2210-PH	10	146.5	255	2
E2610-PH	10	188.4	384	2
E2610-QH	10	183.6	353	2
E2612-PH	12	225.6	435	2
E2612-QH	12	219.8	397	2
E3012-PH	12	299.9	607	2
E3012-QH	12	293.6	565	2
E2614-PH	14	267.1	491	2
E2614-QH	14	260.4	447	2
E3014-PH	14	355.2	626	2
E3014-QH	14	347.7	583	2
E3614-PH	14	522.5	1031	2
E3614-QH	14	509.5	940	2

Notes:

1. Refrigerant charge showed above is only for the evaporator when chiller operated at the normal state. The refrigerant charge of the whole chiller also includes the condenser and economizer. Since the actual

charge will depend on other variables, the actual charge will be shown on the unit nameplate.

2. Water volume is based on standard tube configuration and standard dished heads.

3. Numbers of Relief Valves are based on standard chiller configuration, and quantity is halved when using a single relief Valve.

Condenser

With positive pressure systems, the pressure variance with temperature is always predictable, and the vessel design and pressure relief protection are based upon pure refrigerant characteristics. R134a requires using spring-loaded pressure relief valves. When an over-pressure condition occurs, spring-loaded relief valves purge only that quantity of refrigerant required to reduce the pressure to the valve's set pressure and then close.

Refrigerant-side design pressure is 1400 kPa, and Water-side design is 1000 kPa. The physical parameters of the condenser are shown as below:

Table 3-2

Condenser Code	Tube Length(ft)	Refrigerant Charge (kg)	Condenser Water Volume (L)	Number of Relief Valves
C1803-SK	03	8	108	2
C2004-SK	04	12	123	2
C2009-JK	09	53.4	295	2
C2009-KK	09	54.3	259	2
C2009-MK	09	54.9	239	2
C2210-KK	10	45.4	290	2
C2610-JK	10	88.5	473	2
C2610-KK	10	90.0	431	2
C2610-MK	10	91.2	394	2
C2612-JK	12	105.88	541	2
C2612-KK	12	107.63	490	2
C2612-MK	12	109.1	447	2
C3012-JK	12	119.5	710	2
C3012-KK	12	121.0	667	2
C3012-MK	12	122.4	627	2
C2614-JK	14	124.9	616	2
C2614-KK	14	127.0	556	2
C2614-MK	14	128.7	505	2
C3014-JK	14	144.43	833	2
C3014-KK	14	142.74	781	2
C3014-MK	14	140.93	732	2
C3614-JK	14	196.17	1137	2
C3614-KK	14	192.50	1029	2
C3614-MK	14	188.78	923	2

Notes:

1. Water volume based on standard configuration and standard heads and can be less with lower tube counts.

2. Refrigerant charging: the transport of refrigerant is also taken into account for the method of transport of chiller.
3. Numbers of Relief Valves are based on standard chiller configuration, and quantity is halved when using a single relief Valve.

Electronic Expansion Valve (EXV)

The electronic expansion valve is mainly to regulate the evaporator liquid supply amount according to the preset procedure. It is driven in a way that a controller computes the parameters gathered by the sensor and sends a regulating command to the drive board which then transmits an electric signal to the electronic expansion valve, so as to drive and control its operations. EXV is the best throttling element so all HXE chillers use EXV.

Compressor

HXE chiller's compressors are applied oil-free magnetic bearing and variable-frequency drive (VFD). This reduces the maintenance costs and improves the system reliability.

3.3 Field Insulation Guide

If the optional factory-installation of thermal insulation is not ordered, insulation should be field installed to reduce heat loss and prevent condensation from forming. Insulation should cover:

1. Evaporator barrel, tube sheet, water heads and entering/leaving water pipe;
2. Suction line and compressor supporter;
3. Pipe from expansion valve inlet to the bottom of evaporator;
4. Economizer and the pipes which connected to it;

5. Pipe for staging.

4.About Safety

Statement:

Please be sure to read the safety precautions of this manual completely and carefully before using the unit, and understand your legal rights, responsibilities and safety instructions. Otherwise, property losses, safety accidents and personal safety hazards may be caused. Once the unit is used, it is deemed that you have read and fully understood, approved and accepted all the terms and contents of this statement. The user promises to be responsible for his actions and all consequences arising therefrom. The user promises to use the unit for legitimate purposes only under the premise of complying with laws and regulations, usage standards and common sense of life and agrees to these terms.

DAIKIN is not liable for any direct or indirect personal injury and property damage caused by your failure to follow the warnings and precautions below. Users should read, understand and implement the warnings and cautions including but not limited to this manual.

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. After reading the Manual, please keep it accessible to each chiller operator. Be sure to hand over the Manual to the next person on duty.

4.1Precautions (Machinery room)

●Local building codes and safety standards shall be followed; in absence of local codes and standards refer to EN 378, ASHRAE 15-2019, ISO5194-3 or GB/T9237-2017 as a guide.

●HXE chillers are classified as "indirect heat exchange system" and are designated to be installed in a special machinery room (Class C as per ISO-5149 and EN-378). Please refer to local code or regulation for guidelines for safe use of R1234ze(E) refrigerant in other location such as Ventilated enclosure, open air, etc.

1.1.1 Machinery rooms

- A) Machinery rooms or special machinery rooms shall be clearly marked as such on the entrances to the room, together with warning notices indicating that unauthorized persons shall not enter and that smoking, naked light or flames are prohibited. The notices shall also state that, in the event of an emergency, only authorized persons conversant with emergency procedures shall decide whether to enter the machinery room. Additionally, warning notices shall be displayed prohibiting unauthorized operation of the system.
- B) Refrigerant gas escaping from machinery rooms shall be prevented from entering neighboring rooms, staircases, courts, gangways or building draining systems and the escaping gas shall be vented outdoor without risk.
- C) It shall be possible to leave the machinery room immediately in case of danger.
- D) Flammable materials, other than refrigerants and oil needed for servicing, shall not be stored in the machinery room.
- E) Remote switch for stopping the refrigerating system shall be provided outside and near the machinery room door.
- F) Mechanical ventilation shall be provided with independent emergency control located outside the machinery room and near the machinery room door.
- G) All piping and ducting passing through walls, ceilings and floors of machinery rooms shall be tightly sealed.
- H) Alarms and refrigerant detectors must be installed.
- I) Adequate firefighting equipment have to be available.
- J) If machinery rooms are occupied for significant periods, e.g. Used as a building maintenance workspace, they shall be considered as occupied spaces under occupancy class C "Occupancy with authorized access only". If the building owner or user ensures that access is permitted only

to qualified and trained personnel doing the necessary maintenance to the machinery room or refrigerating system then the machinery room shall be considered unoccupied.

- K) At least one of the emergency exits shall open directly to the open air, or it shall lead to an emergency exit passageway. The doors in the emergency exits shall be such that they can be opened manually from the inside (anti-panic system).
- L) When refrigerating equipment and air compressors are located in the same machinery room, the air supply for the air compressors shall be ducted from outside in such a manner that refrigerant cannot enter the air supply.
- M) Any refrigerants, flammable or toxic materials shall be stored as required by national regulations.
- N) A remote switch for stopping the refrigerating system shall be provided outside the room, near to the machinery room door. A similar acting switch shall be located at a suitable location inside the room. The switches shall meet the requirements for emergency switches.
- O) Exterior openings shall not be situated near within 2m of the building emergency exit staircases or other building openings, e.g. Windows, doors, ventilation inlets.
- P) Machinery rooms shall have doors opening outward and sufficient in number to ensure freedom for persons to escape in an emergency.
- Q) The doors shall be tight fitting, self-closing and so designed that they can be opened from inside (antipanic system).
- R) The doors shall have at least a one-hour fire resistance construction, using materials and construction tested in accordance with EN 1634. There shall be no openings that permit unintended passage of escaping refrigerant, vapors, odors and all other gases to other parts of the building.
- S) Combustion equipment shall not be installed in a machinery room containing an R1234ze(E) refrigerating system.**
- T) Special instructions
 - According to the ASHRAE 15-2019, devices containing hot surfaces exceeding 1290°F (700°C) shall not be located in the duct work that serves the space.
 - According to the EN378, hot surface temperature shall not exceed 294 °C
 - According to the ISO5194-3 or GB/T9237-2017
 1. hot surfaces shall not exceed a temperature of 100 K less than the auto-ignition temperature of the refrigerant.
 2. R1234ze(E) is classified in safety group A2L: Machinery rooms with group A2L, A2, B2L, B2, A3, and B3 refrigerants, where the risk of explosion can occur because it is possible for the concentration of refrigerant to reach the lower flammability limit, shall comply with the requirements of hazardous areas. Some explosion relief (e.g. frangible wall or roof) shall be provided in accordance with national regulations.

1.1.2 Safety alarms

- A) The alarm shall be turned on by the signal from the detector. The alarm shall also alert an authorized person to take appropriate action.
- B) The power source of the alarm system shall be independent from the power source of the mechanical ventilation.
- C) The alarm system shall warn both audibly and visibly such as both a loud buzzer (15 dba above the background level) and a flashing lamp. The alarm system shall warn both inside and outside of the machinery room or at least inside the space where used in an occupied space. For hotels and similar establishments the alarm system shall also warn at a supervised location such as the night porters location as well as the occupied space. The outside alarm may be installed in a watch room or other supervised location.

1.1.3 Machine room ventilation

- A) The ventilation of machinery rooms shall be sufficient both for normal operating conditions and emergencies.
- B) The normal operation of ventilation requirements :
- According to the EN378, ISO5194-3 or GB/T9237-2017 – Ventilation shall be in accordance with National regulations with a MINIMUM OF FOUR AIR EXCHANGES PER HOUR when the machinery room is occupied.
 - According to the ASHRAE 15-2019
 3. Operated when occupied, and operated when activated in accordance, 0.5 ft³/min per ft³ (2.54 L/s per m³) of machinery room area or 20 ft³/min (9.44 L/s) per person
 4. Operable when occupied, the airflow rate required to not exceed a temperature rise of 18°F (10°C) above inlet air temperature or the airflow rate required to not exceed a maximum air temperature of 122°F (50°C) in the machinery room;
- C) The emergency mechanical ventilation system recommends:
- According to the EN378, ISO5194-3 or GB/T9237-2017, airflow of the mechanical ventilation shall be at least the quantity obtained by formula:

$$V = 0.014m^{\frac{2}{3}}$$

Where

V is the airflow rate, in cubic meters per second (m³/s);

m is the mass of refrigerant charge, in kilograms (kg), in the refrigerating system with the largest charge, any part of which is located in the machinery room.

NOTE 0.014 is a conversion factor with units of (m³/s)(kg)^{-2/3}.

- According to the ASHRAE 15-2019, the total airflow for The emergency mechanical ventilation shall be not less than the airflow rate determined by Figure 4-1

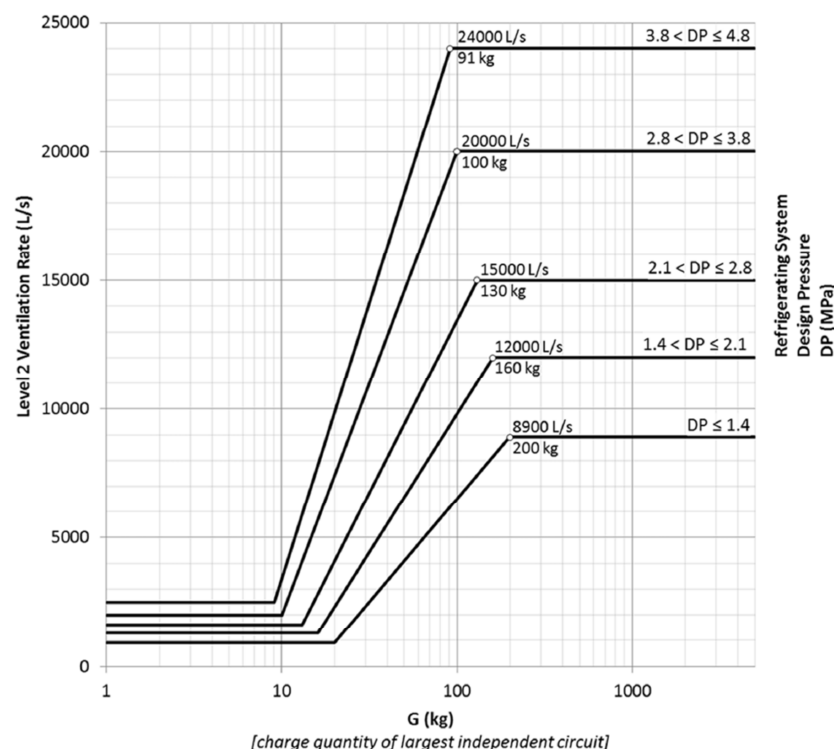


Fig 4-1

- D) The emergency mechanical ventilation system shall be activated by a detector(s), located in the machinery room. Mechanical ventilation shall also be provided with two independent emergency controls one located outside the machinery room and the other inside. It should be initiated by the refrigerant detector and include proof of airflow. When initiated the system should also be interlocked with the chiller and stop the operation of the chiller as well as initiate the mandatory EN-378 alarm systems.
- E) Machinery rooms shall be vented outdoors using mechanical ventilation in case of a release of refrigerant due to leaks or rupture of components. This ventilation system shall be independent of any other ventilation system on the site.
- F) Provision shall be made for a sufficient supply of outside replacement air and a good distribution of that air over the (special) machinery room avoiding dead zones.
- G) Openings for outside air shall be positioned to avoid re-circulation into the room.
- H) The machinery room shall be located in accordance with local and National regulations.
- I) The emergency exhaust ventilation fan shall be either:
 - With the motor outside the airflow or rated for hazardous areas as required in EN-378 (2012).
 - The fan shall be located to avoid pressurization of the exhaust ductwork in the machinery room.
 - The fan shall not cause sparks to occur if it contacts the duct material.
- J) The outlet from the exhaust ventilation shall be in accordance to national regulations. The outlet shall not be restricted but have means of keeping rubbish, leaves and birds from entering. The bottom of any rising ductwork open to the outside shall have a drain with a trap for rainwater and with access for inspection.

1.1.4 Refrigerant **sensors**

- A) The ventilation system, refrigerant sensor and alarm system should be routinely inspected as part of the building fire system inspection procedures at least on an annual basis. For example, a bump test with 3500 ppm gas can be performed every year in order to make sure the **sensors** and mitigation respond as designed (make sure the **sensors** work; make sure the alarm system works; make sure the ventilation system turns on and exhausts the correct amount of air).
- B) All machine rooms should include at least one refrigerant sensor located where the likely highest leak will occur. The sensor should include internal self-checking diagnostics and should be interlocked with the chiller and alarm system to prevent operation of the chiller and enable the alarm if it fails or is disconnected.
- C) All the installed sensors shall have a high respond time <15 seconds (the sensor shall strip within 15 seconds when exposed to FCL) and shall be positioned near the chiller below 0.5 m from the floor.
- D) For R-1234ze(E), the different limits are defined as follow(ASHRAE 15-2019):
 - OEL - Occupational Exposure Limit = 800 ppm
 - ATEL - Acute Toxicity Exposure Limit = 59,000 ppm
 - ODL - Oxygen Deprivation Limit = 140,000 ppm
 - LFL - Lower Flammability Limit = 65,000 ppm
 - FCL - Flammable Concentration Limit equal 25% of the LFL = 16,000 ppm
 - RCL - Refrigerant Concentration Limit determined from the lowest value from ATEL; ODL & FCL =16,000 ppm
 - PL - Practical Limit = 13,094 ppm
- E) The sensor value depends on the quantity and distance from the unit
 - According to the EN378, ISO5194-3 or GB/T9237-2017 the refrigerant detector shall activate the alarm signal at a level not exceeding 25 % of the LFL of the refrigerant. the

detector shall continue to activate at higher concentrations. the detector shall be set lower for the toxicity, if applicable. it shall automatically activate an alarm, start mechanical ventilation, and stop the system when it triggers.

- According to the ASHRAE 15-2019, refrigerant detector set points as table 4-1:

Table 4-1

Limit Value	Response Time, seconds	Alarm Type	Alarm Reset Type	Ventilation Reset Type
RCL	15	Emergency alarm	Manual	Manual

4.2 Precautions (Installation)

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

Warning:

- A) All valves must be closed during shipping.

After arrive at the site, do not open the valves until DAIKIN technicians start the chiller.

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

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

- C) Prevent refrigerant leakage.

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

- D) Strictly follow this manual during installation.

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

- E) Electrical cable shall be wired or connected by qualified and professional electrical engineers.

Please size the cable according to local electrical standard or refer to "6.4 Electrical Construction". Undersize cable might cause electrical shock or fire, etc.

- F) 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.

- G) Chiller shall be installed in indoor space.

If chiller is installed in rainy or water dropping place, creep age or electrical shock might happen.

- H) Use specified cable and ensures the connections are firm.

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

- I) Danger

If an individual power distribution line is used, to avoid injuries and death. Please follow:

- Stick a label on the chiller: multiple power supply;
- Stick a label on the main switch of main power and control power: Another power supply to the motor.

- J) The cables connecting to the compressor motor must be copper line and copper cold-pressed terminal.

- K) 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.

- L) Chiller shell shall be grounded.

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

- M) 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.

- N) 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.

- O) 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.

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

- Q) Chiller plant floor shall go through water proof treatment.

Water proof floor will protect chiller from moisture.

- R) 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.

- S) It is forbidden to close the AC contactor to start the compressor.

It may cause electric shock or fire accident.

Attention:

- A) 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.

- B) 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.

- C) 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.

- D) It is forbidden to charge other kinds of refrigerant or lubricant in chiller.

It may cause chiller instability, chiller efficiency decrease, or even fire accident.

- E) Ensure sufficient space for chiller service and maintenance.

Insufficient space will threaten operator or service people's safety.

- F) Law & regulation

Highest possible compliance with all local, national and international regulations on lifting and refrigerant emissions.

4.3Precautions (Operation)

Warning:

- A) The chiller needs to be energized first and keep standby for 24 hours before running.**

- B) If chiller running abnormally (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.

- C) 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.

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

E) 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.

F) Do not touch DC-DC device and its cable in control cabinet when power is on.

G) Do not operate the chiller with wet hands.

This is one of the causes of electrical shock.

H) It is prohibited to use oversized fuse.

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

I) It is prohibited to locate the chiller in flammable gas circumstance.

It might cause fire accident.

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

It may cause fire accident or electrical shock.

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

It may cause fire accident or explosion.

L) It is prohibited to start the chiller when open the starter door.

It may cause electrical shock or fire accident.

M) Ensure the power supply is correct.

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

N) It is prohibited to put any vessel which contains water on the chiller.

If water seeps in control box, the insulation may become worse or even cause electrical shock.

O) It is prohibited to flush the chiller.

It will cause electrical shock.

P) Don't feed other category of refrigerant in chiller.

This might cause chiller operating abnormal or efficiency reducing. And it is also a cause of fire or explosion.

Q) Treat the chilled water/cleaning agent/wasted refrigerant according to local rules.

Illegally dump the waste will break the law and harm environment.

R) It is prohibited to change the protection set point.

It may cause fire or explosion.

S) Do not start the chiller when the check valve fault tripped, unless the fault is cleared.

T) During service operation, continue to ventilate the air using the machine room ventilation or temporary fans.

Attention:

A) Chiller can't 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) It is prohibited to put or hang any object upon the chiller.

Dropping of the object might damage the chiller.

C) Check the foundation after chiller operates for certain period.

Unreliable foundation may cause chiller distortion or even accident.

- D) Stop the chiller and cut off the power supply when cleaning the chiller.

Otherwise it may cause accident.

- E) It is prohibited to drink chilled water or cooling water.

It's not healthy to drink cooling or chilled water.

- F) Water quality must be ensured.

Bad water quality might cause chiller capacity reduce or water leakage.

- G) Don't touch the compressor and discharge pipes.

It will cause scald.

- H) 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.

- I) Measure the resistance.

Do not measure the resistance when the chiller is in a vacuum condition, otherwise serious consequences may be caused.

- J) Evaporator water temperature.

The evaporator entering water temperature shall not be more than 43°C, otherwise it may open the relief valve, leak refrigerant and damage control components.

- K) Make sure the pressure is 0kpa before starting ANY WORK

Make sure that there is no residual pressure inside the chiller before starting ANY WORK, otherwise the pressure will make small parts like bolts or flange fly and hurt operators.

Use the vacuum pump to make sure that the pressure inside the chiller is 0 kPa before servicing.

Release pressure of evaporator and condenser by the stop valve on the vessel, Release pressure of compressor by the Thimble valve on the pipes which connected to the compressor. After the pressure relief operation, it needs to be measured with a pressure gauge to ensure that there is no residual pressure inside the compressor before maintenance.

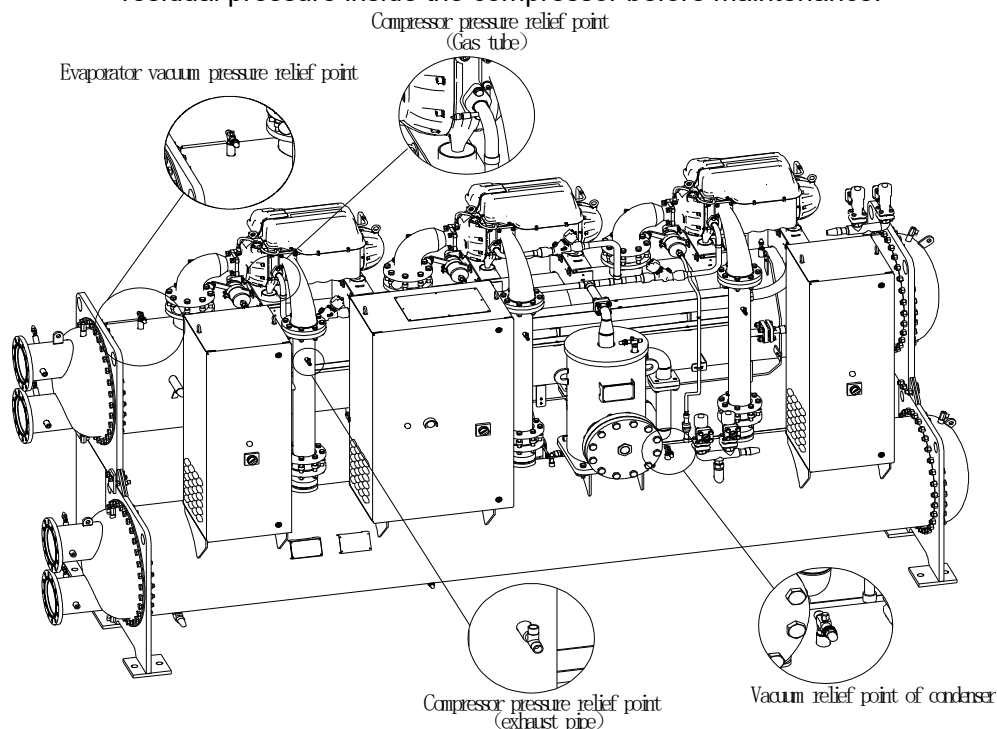


Fig 4-2

4.4 Precautions (Removal, maintenance 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.
- D) 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.
- E) Don't mix with other categories of refrigerant in chiller.
It may cause fire accident or explosion.
- F) It is prohibited to change the set point of protection device.
It may cause fire accident.
- G) It's prohibited to bypass the protection device when starting the chiller.
It will cause fire accident.
- H) When performing service on the refrigeration circuit, ventilate the area prior to performing any work and check for presence of refrigerant.
Refrigerant leakage will reduce the concentration of oxygen. So it may cause suffocation when ventilation is insufficient.
- I) When servicing the refrigerant circuit, all ignition sources should be disabled.
- J) At least once a year thoroughly inspect the protection devices(valves). If the machine operates in a corrosive environment, inspect the protection devices more frequently.
- K) It is compulsory to wear personal protection equipment and a detector of explosive atmospheres.
- L) Each time repairs have been carried out to the unit, the operation of the protection devices must be re-checked.
- M) Do not unweld or flame cut the refrigerant lines or any refrigerant circuit component until all refrigerants (liquid and vapour) has been removed from chiller and the system has been purged with nitrogen. Traces of vapour should be displaced with dry air nitrogen. Refrigerant in contact with an open flame produces toxic gases.
- N) Avoid contact with liquid refrigerant on the skin or splashing it into the eyes. Use safety goggles. Wash any spills from the skin with soap and water. If liquid refrigerant enters the eyes, immediately and abundantly flush the eyes with water and consult a doctor.
- O) The accidental releases of the refrigerant, due to small leaks or significant discharges following the rupture of a pipe or an unexpected release from a relief valve, can cause frostbites and burns to personnel exposed. Do not ignore such injuries. Installers, owners and especially service engineers for these units must:
- Seek medical attention before treating such injuries.
 - Have access to a first-aid kit, especially for treating eye injuries.
- We recommend to apply standard EN-378.
- P) Proper refrigerant cylinders designated and marked for R1234ze (E) should be used. When cylinders are empty, evacuate the remaining gas pressure, and move the cylinders to a place designated for their recovery. Do not incinerate.
- Q) Use only original replacement parts for any repair or component replacement. Consult the list of

replacement parts that corresponds to the specification of the original equipment.

- R) When occupied for maintenance or repair, a duly authorized person, familiar with the use of the emergency protective equipment and emergency procedures, should be available near to the machinery room during such occupation in case of an emergency. During service the room should be ventilated using the machine room ventilation system or locally supplied fans.

5.About Handling

5.1 After the chiller arrived at the site

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

Chiller injury or parts or document loss caused by client is out of warranty scope.

Anti-vibration pad

The shipped-loose neoprene vibration pads should be located under the corners of the unit. HXE chillers have four mounting feet. Four pads are shipped.

If customer need isolation device, flow switch, butterfly valve such accessory, DAIKIN could provide as per order request and put into accessory box shipped with the unit.

The HMI will ship as accessory together with the chiller and it must be field installed.

5.2 Lifting

Evaporator hole for hoist position of insulation and damping pad o should be removed in the process of transportation, after the last setting put back in place.

It shall tighten carefully when it is to be hoisted, in order to avoid damage to the controller and pipeline. .

On the four corners have a hole for hoist, when lifting unit, shaft support, should be used in case the sling damage control panel and other parts.

Warning:

- A) Do not use the lifting lug of compressor or starter to lift the entire chiller.
- B) The lifting rope must prevent to touch the parts or pipes.

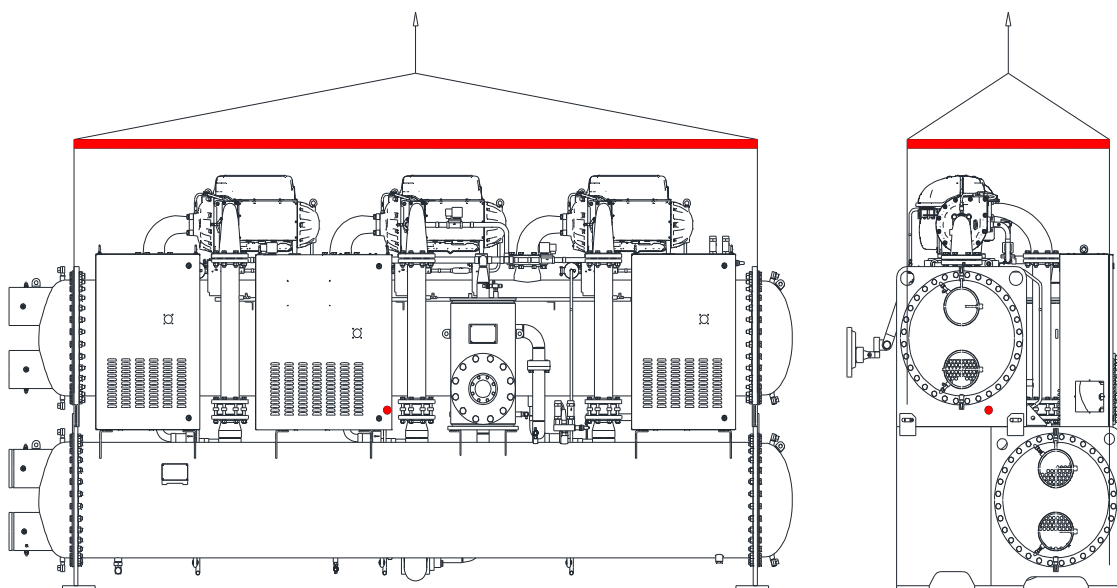


Fig. 5-1 Schematic of HXE lifting

Notes:

1. It is only allowed to lift with the marked lifting location on the chiller.
2. Ensure chiller is horizontal when lifting.
3. If the chiller cannot be lifted through 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.
4. Chiller shall be located in horizontal foundation and sufficient space shall be provided on top for lifting.
5. Certain protection for starter is required during lifting with method 3.

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

Table 5-1

Chiller Model	Shipping Weight (kg)	Operating Weight (kg)
HXEM/C2203-SL/C1803-SK	1426	1600
HXEM/E2204-SL/C2004-SK	1558	1803
HXES/E2209-PH/C2009-JK	3068	3605
HXED/E2210-PH/C2210-KK	3881	4425
HXED/E2610-PH/C2610-JK	4682	5572
HXED/E2612-QH/C2612-JK	5206	6145
HXED/E2612-PH/C2612-JK	5220	6195
HXET/E2612-QH/C2612-JK	5793	6760
HXET/E3012-QH/C3012-MK	6948	8273
HXET/E2614-PH/C2614-JK	6390	7497
HXET/E3014-QH/C3014-KK	7479	8844
HXET/E3014-PH/C3014-JK	7639	9100
HXEQ/E3614-PH/C3014-JK	9620	11577
HXEQ/E3614-PH/C3614-JK	10488	12777

Notes: chillers showed above are the standard models, the weight of nonstandard chillers needs to see the nameplate. Please confirm the weight of nameplate again before lifting. The package is weighed to 200kg according to the model size.

5.3 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 Installation 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) Standard 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 3C~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 tower and easily corrosive 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 and cloaca. Otherwise condenser tube corrosion might cause refrigerant leakage. If client use sea water or river water as source of the cooling water, then special design of condenser shall be considered.

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.

The surface of the foundation shall be horizontal and smooth. (levelness < 1mm/1,000mm)

Please construct according to the foundation drawing for the foundation sizes. The foundation drawing of HXE chillers is showed in Fig. 6-1 and Table 6-1. These parameters are for rubber isolators.

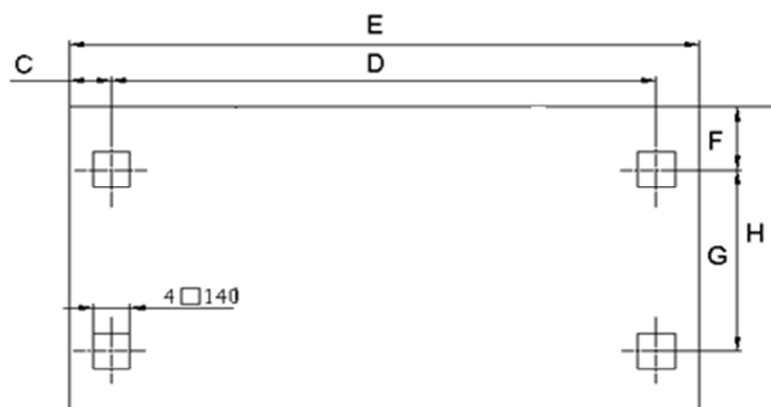


Fig. 6-1 Foundation drawing of HXE chillers

Table of chiller Foundation Drawing Parameters

Table 6-1

Chiller: mm

Model	C	D	E	F	G	H
HXEM/E2203/C1803	500	1250	2250	300	800	1400
HXEM/E2204/C2004	500	1350	2350	300	800	1400
HXES/E2209/C2009	156	2808	3120	200	1023	1423
HXED/E2210/C2210	156	3108	3420	200	1023	1423
HXED/E2610/C2610	156	3109	3421	200	1198	1598
HXED/E2612/C2612	156	3694	4006	200	1198	1598
HXET/E2612/C2612	156	3694	4006	200	1198	1598
HXET/E3012/C3012	156	3694	4006	200	1279	1679
HXET/E2614/C2614	156	4345	4657	200	1198	1598
HXET/E3014/C3014	156	4345	4657	200	1279	1679
HXEQ/E3614/C3014	156	4345	4657	200	1831	2231
HXEQ/E3614/C3614	156	4345	4657	200	1930	2330

Note: Do not build anchor bolt in the concrete when use spring isolator.

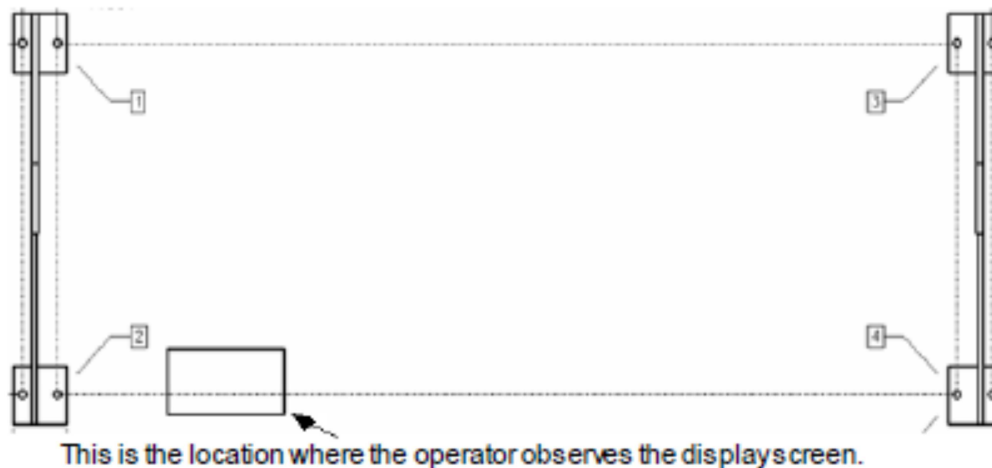


Fig. 6-2-1 HXE Schematic of the chiller feet

If client need to use spring isolators, here are the recommend selected specifications:

Table 6-2

chiller: kg

Model	Support leg 1	Support leg 2	Support leg 3	Support leg 4
	Recommend load	Recommend load	Recommend load	Recommend load
WXEM/E2203/C1803	450	330	473	347
WXEM/E2204/C2004	492	377	528	406
HXES/E2209/C2009	1100	900	1100	900
HXED/E2210/C2210	1400	1100	1400	1100
HXED/E2610/C2610	1700	1100	1700	1100
HXED/E2612/C2612	2600	1700	2600	1700
HXET/E2612/C2612	2100	1700	2100	1700
HXET/E3012/C3012	2100	2100	2600	2600
HXET/E2614/C2614	2100	1700	2100	1700

Model	Support leg 1	Support leg 2	Support leg 3	Support leg 4
	Recommend load	Recommend load	Recommend load	Recommend load
HXET/E3014/C3014	3400	2600	3400	2600
HXEQ/E3614/C3014	2800	2800	3200	2800
HXEQ/E3614/C3614	4200	3800	4200	4200

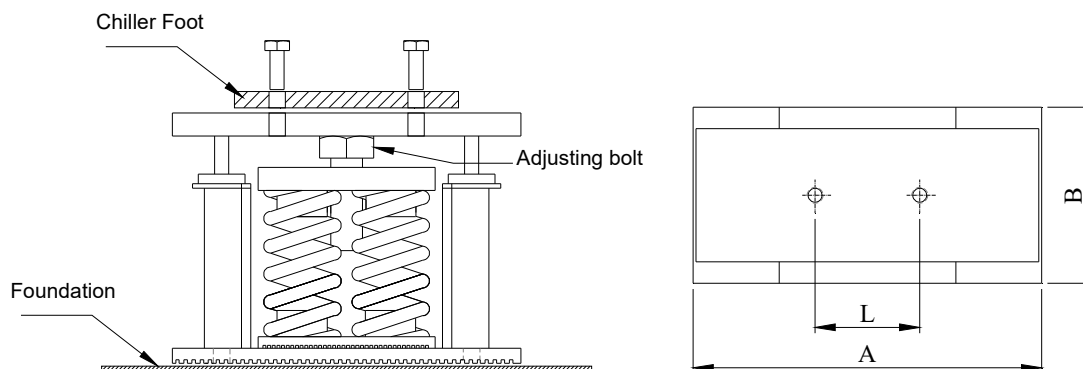


Fig. 6-3

Fig. 6-3 shows the schematic of the spring isolator installation, in which AB is the edge length of the spring isolator and L is the distance between the two bolt holes on the bottom.

Please check the model of spring isolator first before mounting. Then put the spring isolator under chiller and put down chiller slowly. Use the M27 bolts to fix the chiller and spring isolator but do not tighten completely right now.

After confirming the spring isolator located perpendicular, put the spring isolator on the concrete foundation. Every spring isolator has a rubber cushion to prevent chiller sliding. If client really need to fix the spring isolator to the concrete foundation, ask Daikin to get the location of the anchor bolt.

After installation, please check whether the unit is horizontal. If the chiller is not horizontal, adjust the adjusting bolt to make the chiller keep horizontal. Then tighten the M27 bolts to fix the chiller completely.

The location of the four spring isolators is the same to anti-vibration pads shown in Figure 6-2, the two holes in each corner match the two bolts on spring isolator.

1) The chiller must be located to provide sufficient service clearances.

One side of chiller shall be reserved with enough space (at least the length of one vessel) to provide necessary service clearance for changing the evaporator/condenser heat exchange pipes possibly occurred, and the specific parameters are as shown in the following table.

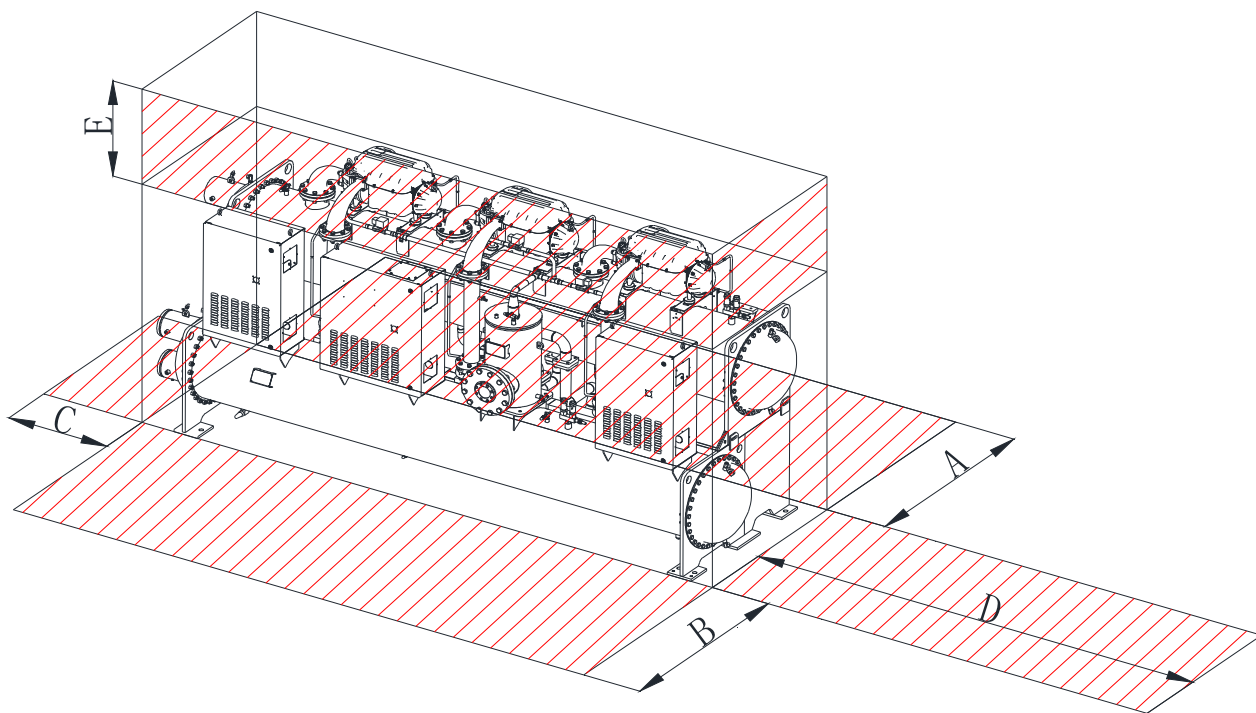


Fig. 6-4-1

Table 6-3

Evaporator/Condenser Barrel Length (ft/m)	A (ft/m)	B (ft/m)	C (ft/m)	D (ft/m)	E (ft/m)
3/1.1	3/1	3/1	3/1	4/1.3	3/1
4/1.2	3/1	3/1	3/1	5/1.6	3/1
9/2.75	3/1	3/1	3/1	9/3	3/1
10/3.05	3/1	3/1	3/1	12/4	3/1
12/3.66	3/1	3/1	3/1	14/4.7	3/1
14/4.27	3/1	3/1	3/1	16/5.3	3/1

Note: C and D can be exchanged according to the client's requirement.

J) 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.

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

L) Cushion block on the bottom of unit must be removed before installation.

M) The spacing between modules must be greater than 150 mm.

6.2 Soundproofing and Anti-vibration Works

A) Please pay attention to the echo.

As the effect of echo and other equipment operation, sometimes the unit internal sound will become big a lot.

Please take the setting statuses of chiller and surrounding machines into account, and sufficient soundproof measures shall be taken.

B) Prevent vibration from piping transferring.

The chilled water pipe, cooling water pipe and relief valve drain pipe all may transfer vibration to unit, and may produce noise, Please use flexible joint in unit water connection to cut off the vibration source.

C) Take suitable anti-vibration measures according to jobsite condition.

The neoprene vibration pads are standard option of unit, please refer to figure 6-1 to install, and it is enough to get good anti-vibration effect.

But if install in buildings middle floor or particularly worried about vibration place, please according to the requirement to use spring isolator.

DAIKIN can provide the spring isolator according to user's requirement.

D) Requirements for spring shock absorber installation of the unit:

check the levelness of the unit installation, confirm and optimize the height of each foot spring, make the levelness of the unit installed on the spring as flat as possible, and the levelness in the length direction and width direction of the reference falling film unit must be within 6.5mm at the same time;

6.3 Chiller Piping

The piping works are responsibilities of the water system design chiller, and the following contents are for reference only.

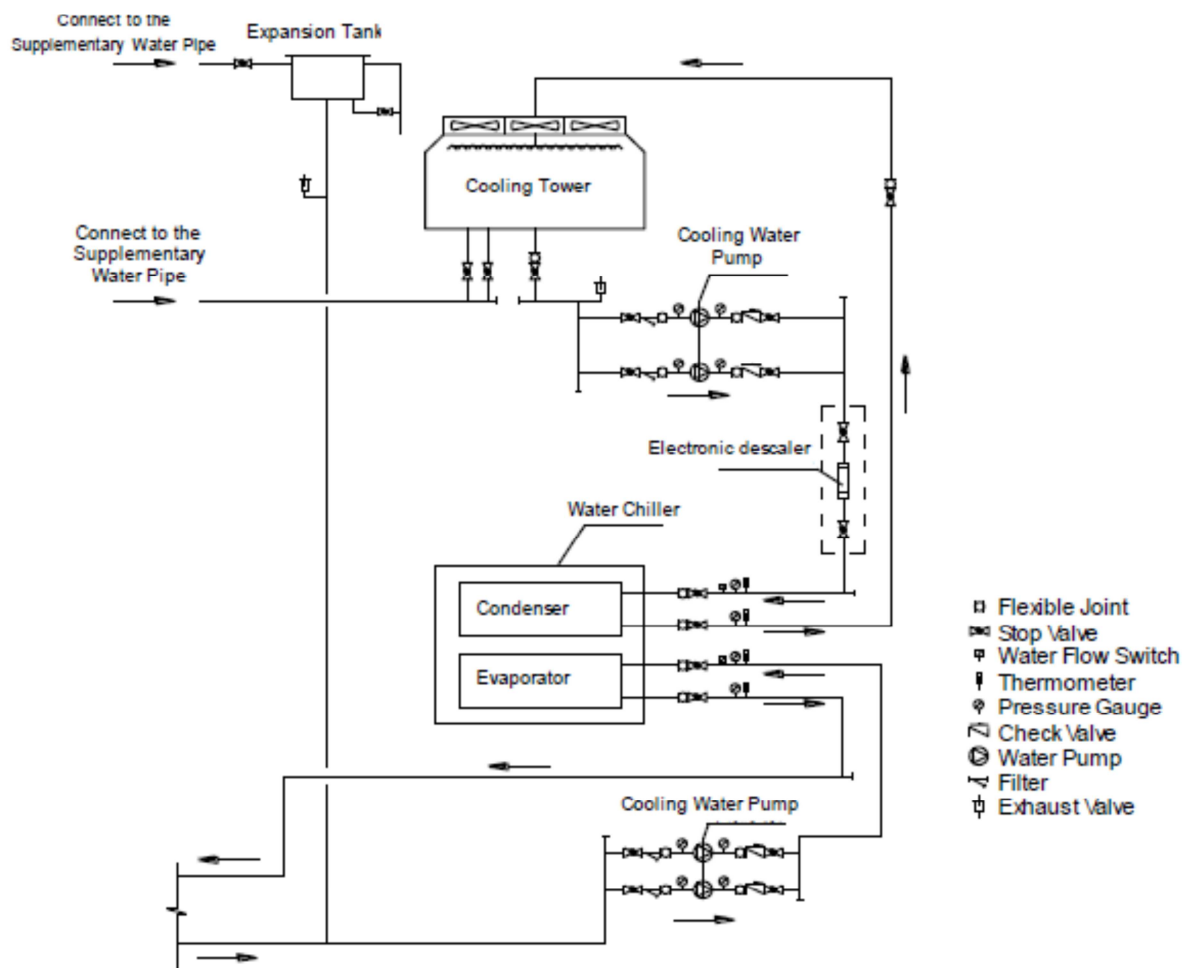


Fig. 6-5

A) Anti-Vibration

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

B) For proper Flow Rate

- Check the air tightness of pipe works before connecting chillers.
- Notices: Ensure the correct connection of condenser and evaporator inlet/outlet pipeline.
- Flow regulation valve (if any) must be set in the central of entrance pipe nearby the chiller. 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.
- 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.
- 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.
- The chiller would control the cooling water pump, chilled water pump and cooling tower fan, 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

- Strainer and drain pipe shall be installed in water loop.
Sand\muck\rust in water loop will corrupt metals such as chiller tubes.
- The strainer shall be installed near and in the inlet pipe of chiller.
Please use 40 mesh filters.
- Check the filter and drain port periodically.
Consider its service space during installation.
- It is necessary to remove the scale in the chiller regularly.
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.
- 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

- Install ventilation valves to ventilate the air in the system.
Air in water system will reduce chiller efficiency and shorten service life of tubes.
- Be careful on the water flow rate, too high flow rate will cause tube cavitation, etc.
- Unit is using circulating water as the prerequisite. Use treated water (warm water), especially in cooling water system internal or free oxygen dissolved oxygen can cause damage to the pipe, so please avoid.
- Too much oxygen in water will increase water causticity.

E) Follow the chiller operation guide

- Please ensure chiller operates within the maximum working pressure.
- To prevent unit frequent start/stop, and steady operation, please ensure the chilled water system water volume over than minimum.

F) Pipe and tube internal anti-corruption treatment

- It is forbidden to install grounding cable on water pipe to prevent electrical erosion.
- Anti-corruption treatment shall be taken for buried pipes.
- Prevent condenser and evaporator from water and air interface.

- For the half-sealed cooling water system with a cold storage tank, please change the water regularly and clean and inspect the bottom of the cold storage tank (one time per one to two years).

The pH value of the newly set cold storage tank may increase to above 10. If the pH value exceeds the standard, it will increase the corrosion rate of the copper product; therefore, it is necessary to change the water in advance. If using for a long term, the cold storage tank will be cracked, thus leading to the water penetration or water leakage. There is little effect of water leakage to the water quality control, but if penetrating in the sea water or polluted ground water, the water in the cold storage tank will contain particles or calcium carbonate due to vast microorganism.

- Please enhance the water quality control especially that of the cooling water. Otherwise, it will reduce the performance and damage the heat transfer pipe.

G) Chiller freeze-proofing

- 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.
- If the ambient temperature is below 0°C, heat the water in chiller tubes to prevent freezing.
- Chiller plant room might equip heater to prevent water freezing in chiller unit.
- If chiller seasonally stops in the plant room where temperature goes below 0°C, operator must drain the water in chiller tubes. Otherwise Wuhan won't be responsible for the damage or loss caused by this.
- Notice the water inlet\outlet indications when connect the chiller to the water system.

6.4 Electrical Construction

The follow table is the specification of power wire

Table 6-4

Voltage level (V)	Max current (A)	Cable length (m)	Sectional area of each phase cable (mm ²)
380-460	170	≤100	≥95
	240	≤100	≥150
	330	≤100	≥185
	420	≤100	≥240
	560	≤100	≥370
	670	≤100	≥480
	780	≤100	≥555
	930	≤100	≥720
	1050	≤100	≥750
	1180	≤100	≥900
	1250	≤100	≥960
	1430	≤100	≥1200
	1600	≤100	≥1300

Note: (1) Cable selection must meet the working voltage level. The wire diameter specification satisfies Table 6-4. The upper limit of the incoming cable length must be guaranteed to meet the range of the starter supply voltage: ±10% of the rated voltage, data is for reference only and must be in accordance with local standards. 380~460V is recommended to use YC, VVR, YJVR line type (multiple cables can be used in parallel to achieve cross-sectional area requirements). The cable walker frame does not pass through the pipe. The specific wire diameter should also consider the actual conditions such as the heat dissipation condition of the wire (cable). If it is necessary to wear the pipe, increase the cable cross-sectional area as appropriate.

A) Accessories have indeed connection

Confirm the correct wiring, prevent inverse phase.

Please note do not let the port connection under external force.

All the wiring shall be confirmed after completion of wiring.

Power cables should be installed to meet the power cable through the screw connection should have two outer flat washer, gasket between adjacent bolts should be more than 3mm spacing, nut side should be fitted with a spring washer or locknut. The contact surface between the bus should be connected tightly, apply torque wrench to tighten bolts, fastening torque value specified in Table 6-5.

Table 6-5

Bolt Specifications (mm)	Torque value (N·m)
M8	8.8~10.8
M10	17.7~22.6
M12	31.4~39.2
M14	51.0~60.8
M16	78.5~98.1
M18	98.0~127.4
M20	156.9~196.2
M24	274.6~343.2

B) Grounding cable must be wired

①Control box grounding

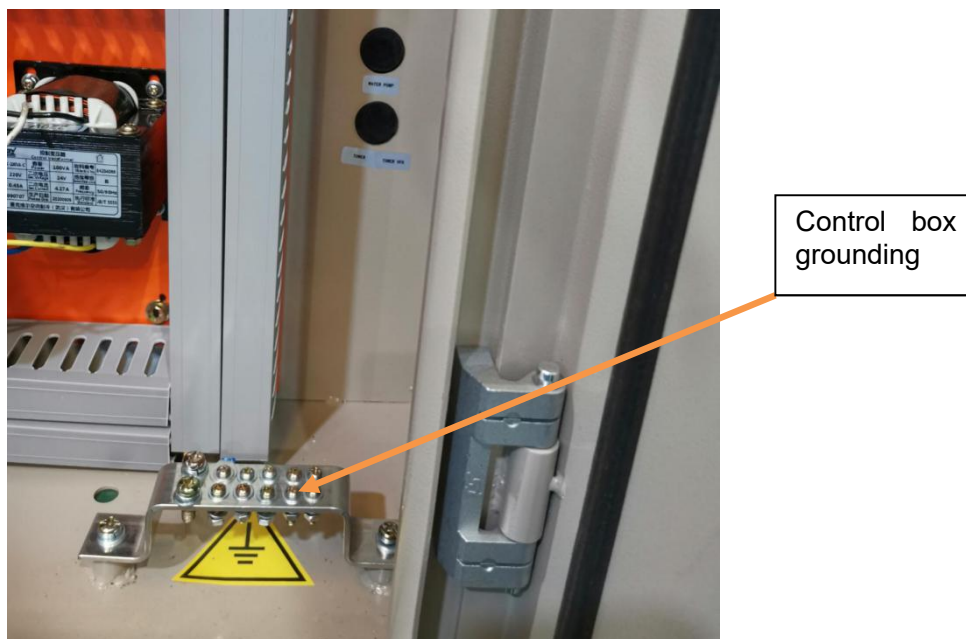


Fig 6-6

②Starter grounding



Fig 6-7

To prevent electrical shock, starter grounding terminals and chiller foot print shall be grounded.

Cable wiring work shall be done by qualified and professional engineers.

★Grounding resistance shall be less than 0.1Ω .

Attention: Grounding cable shall be kept certain distance with natural gas \lightening rod and telephone cables. And don't connect water pipes to grounding cable.

Gas pipe---gas leak can cause explosions or fires.

Water pipe--- there is no ground effect if hard vinyl material is used.

Telephone grounding line and the lightning rod--- under thunderstorm weather, it may cause abnormal rise of grounding voltage.

Starter and control box grounding can refer to national standard.

The grounding cable diameter is generally half of the three-phase wire diameter.

The grounding cable diameter of the unit control cabinet is 10mm^2 .

C) Precautions during installation

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

If need trepanning in controller or starter, must do effective protection for components in it, in order to prevent the metal debris adhere and the components form a short circuit.

Don't break the terminals during cable connecting.

Clean the cabinet and tools when above work is finished.

Important Notices: the chiller voltage shall be within $\pm 10\%$ of name-plate voltage and the unbalance of phase voltage shall not exceed 2%. The voltage unbalance of 2% will cause the current unbalance 6-10 times of voltage unbalance. Thus it's vital to keep the unbalance between phases in a low level.

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:

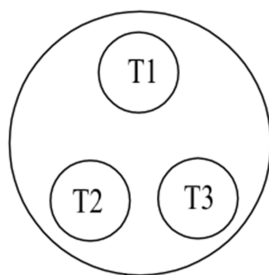


Fig. 6-8

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

E) Unit grounding instructions

一、The role of unit grounding

The main function of the unit grounding is to prevent personal shocks, damage to equipment and lines, prevent fires and lightning strikes, prevent electrostatic damage and ensure the normal operation of the power system.

二、The requirement of unit grounding

1、Definition of ground wire:

The grounding wire refers to the wire that does not carry current under normal conditions for the connection between the grounding copper bar of the unit and the actual grounding electrode or other common grounding devices or the grounding bar.

2、Grounding wire requirements:

1) Grounding wire cross-sectional area requirements:

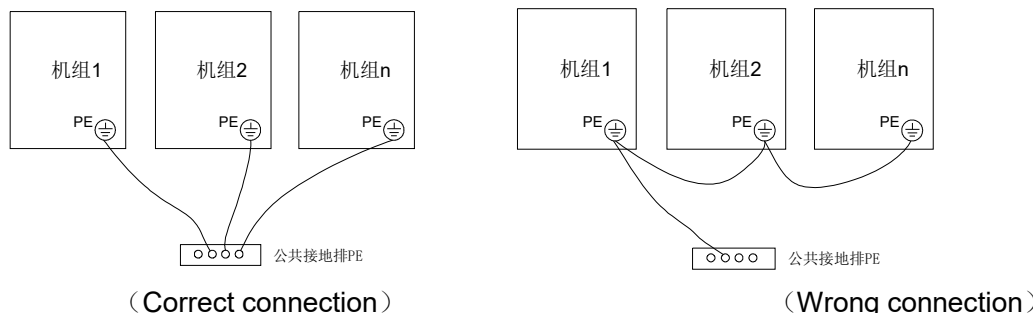
Cross-sectional area of phase line S (mm^2)	Grounding wire cross-sectional area (mm^2)
$S \leq 16$	S
$16 < S \leq 35$	16
$S > 35$	$S/2$

2) Ground wire length requirements:

It is recommended that the length of the grounding wire should not exceed 100 meters and should be as short as possible. When it exceeds 100 meters, it is recommended to re-install the ground row nearby.

3、Grounding requirements for single or multiple units:

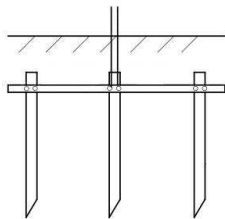
During the construction of the unit wiring, it is necessary to ensure that each unit is separately grounded, as shown in the figure below:



4、Ground electrode requirements:

Except for the TN-S system, the other power supply systems (IT, TT, TN-C, TN- $\rightarrow$ CS) involve the user grounding problem. It is recommended to use an independent grounding electrode (as shown in the schematic diagram), and ensure that the unit is connected to the ground row The

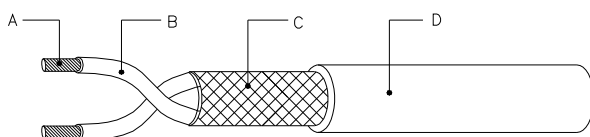
grounding resistance is less than 4Ω . In addition, it is not allowed to use on-site metal pipes (such as water pipes, gas pipes, etc.) as grounding electrodes.



Schematic diagram of grounding electrode

F) Description of communication between units

1、1. Specification requirements for communication lines:



屏蔽双绞线图例

A: Conductor (stranded with tinned copper wire, cross-sectional area at least 0.5mm^2 or 20AWG)

B: Insulator

C: Shielding layer (twisted or braided tinned copper wire, shielding rate is at least 95%)

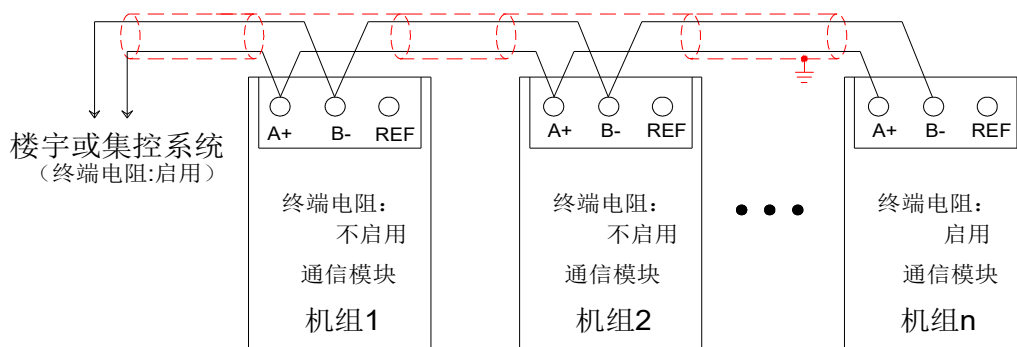
D: Outer sheath (PVC)

Directions: 1) Try to choose a network cable with a tight shielding layer and a small wire lay length (recommended lay length is 5cm).

2) Refer to the use of UL2547 or UL2791 wire, or use RVVP 2x0.5 or RVVP 2x0.75 national standard shielded twisted pair.

2、Communication line wiring requirements:

- 1) When the unit is connected to a building or a centralized control system, the shielding layers of each communication line must be connected to each other, and one end of the shielding layer and only one end must be grounded.
- 2) The communication equipment of the head-end building or the centralized control system needs to be equipped with a terminal resistance and enabled, the terminal unit's communication module must be enabled with a terminal resistor, and the intermediate unit's communication module's terminal resistance is not enabled. (The terminal resistance is recommended to be 120Ω).
- 3) The communication lines should be laid far away from strong wires, and the spacing should meet the specification requirements.



Field Wiring Diagram for starter:

HXEM:

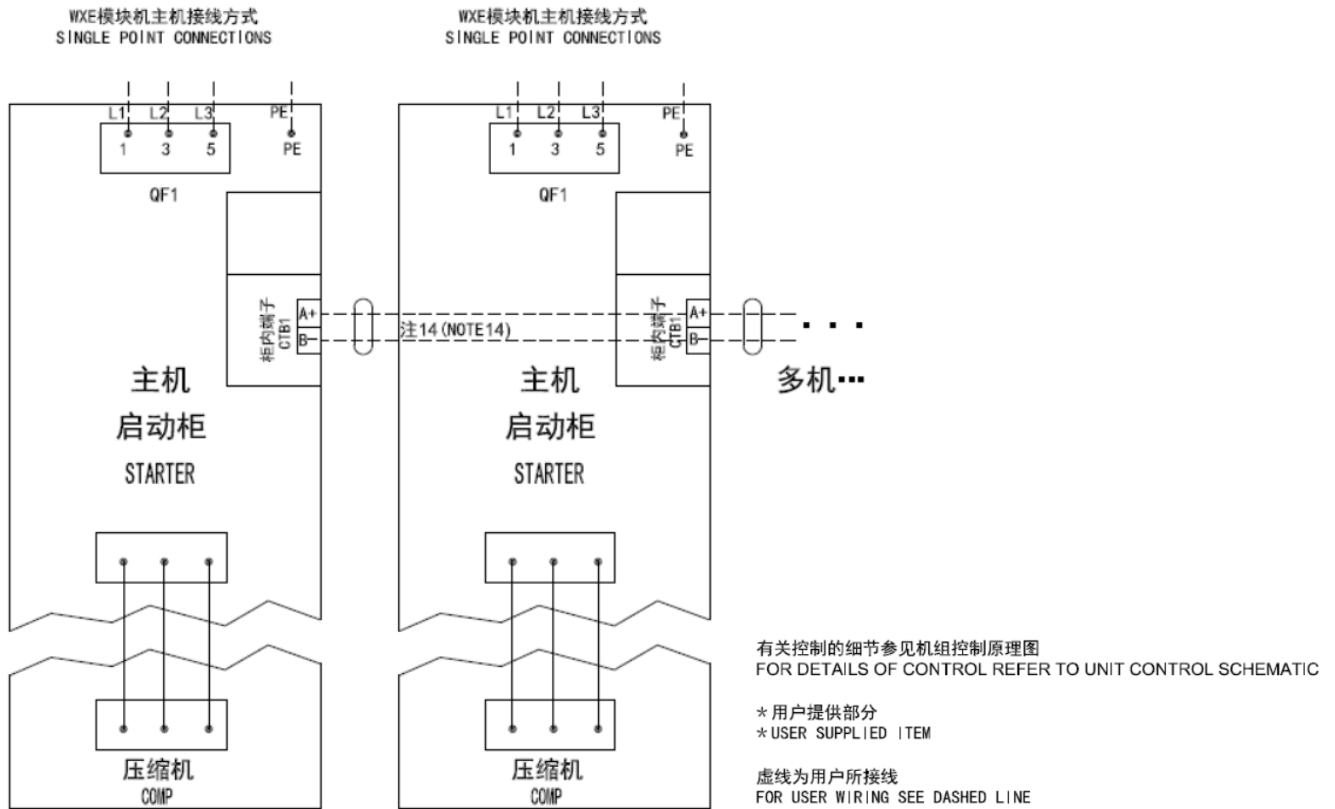


Fig. 6-9

NOTE: Refer to attached drawing for detailed wiring diagram.

HXED

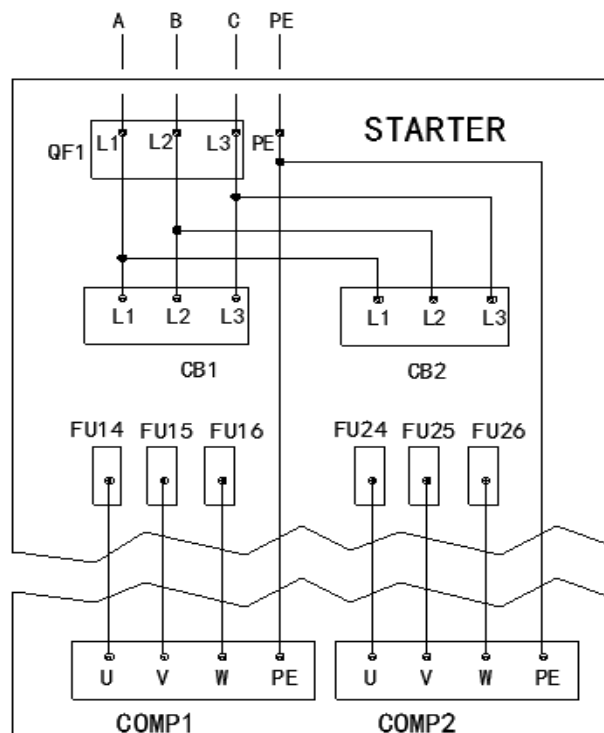


Fig. 6-10

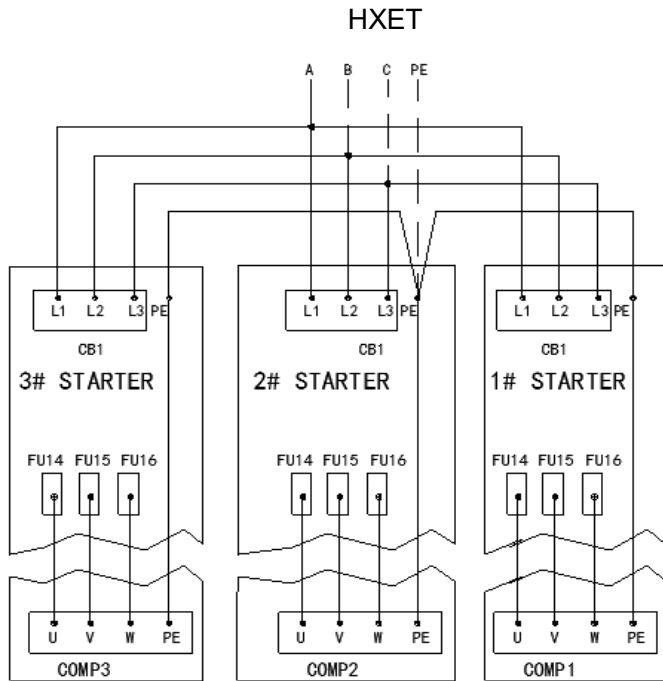


Fig. 6-11

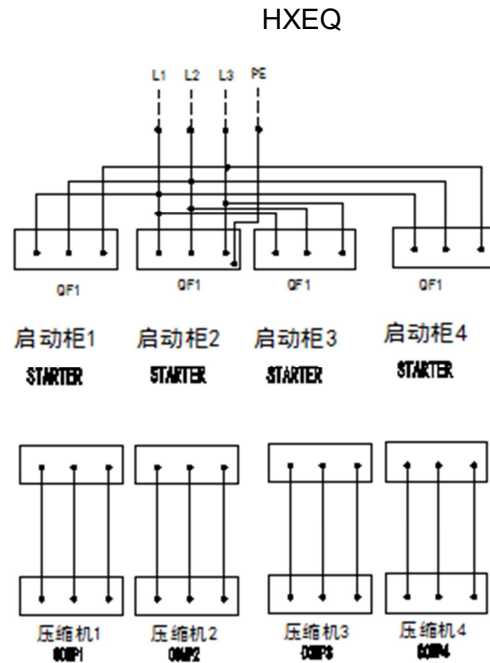


Fig 6-12

Field Wiring Diagram for control box:

The power of control box is supplied by the transformer in the starter.

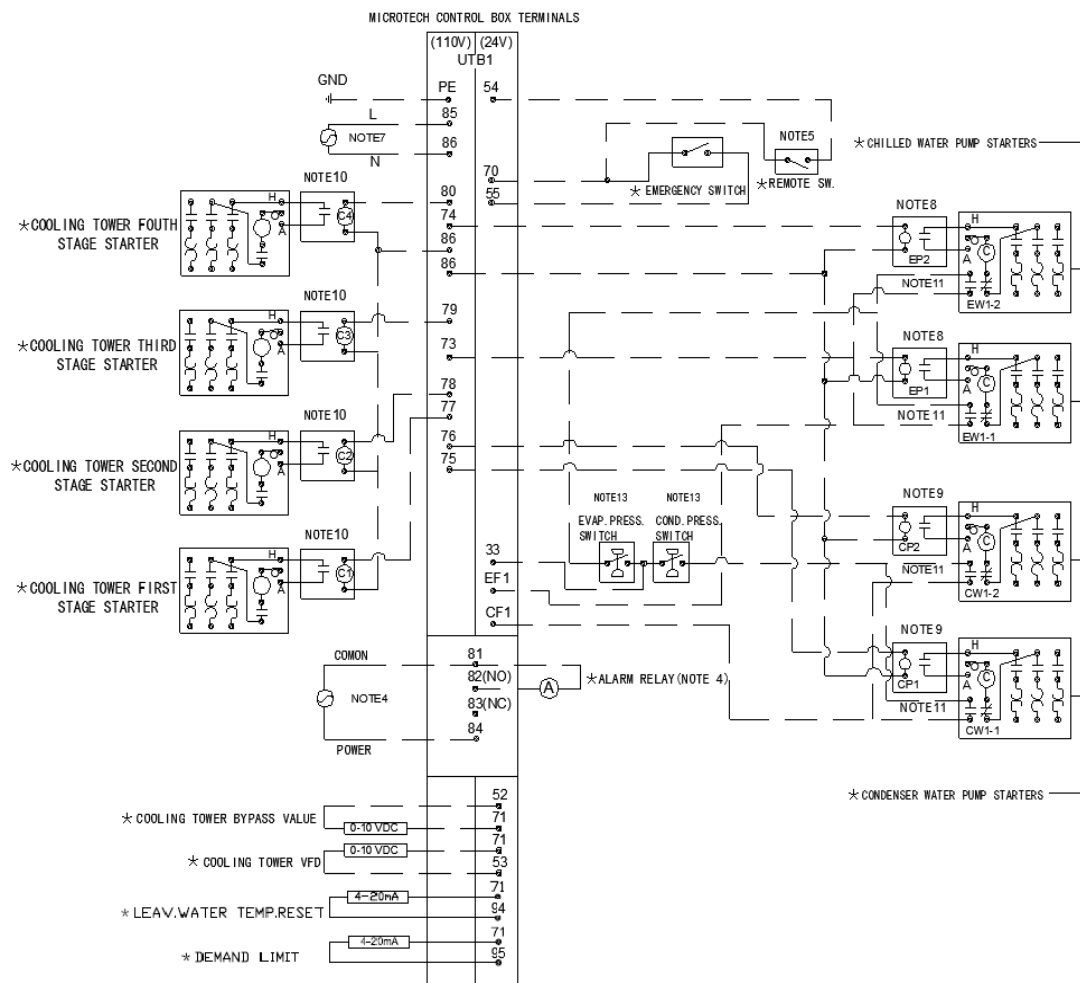


Fig. 6-13

Notes of field wiring diagram:

1. The terminal box of compressor shall be wired with copper core cable only after it has been assembled completely in the plant. The connection of power lines between terminal box and compressor terminal shall be completed in the plant.
2. The min cable type is 2.5mm when the line length is the min allowed length of 15.24m. If line length is longer than 15.24m. The min cable type is 4mm. The wiring of 24VAC and 110VAC shall be distributed in different wire duct. Copper core cable shall be used only.
3. The voltage unbalance shall not exceed 2%, which will cause the current unbalance 6-10 times than voltage unbalance.
4. Customers shall install power supply of 24VAC or 110VAC, because the coil of alarm relay may be connected between terminals 84 and 81. The normally open contacts are terminals 82 and 81 and normally closed contacts are terminals 83 and 81. Alarm is programmable for operators. The alarm relay coil of the highest level is 25VA.
5. Remote on/off control of unit can be accomplished by installing a set of dry contacts between terminals 70 and 54.
6. Evaporator and condenser flow switches are required and must be wired as shown. If field supplied pressure differential switches are used then these must be installed across the vessel and not the pump. Flow switches are factory wired.
7. Customer must supply 110VAC, 20A power for optional evaporator and condenser water pump control power and tower fans. This power supplies to unit control terminals UTB1 85/8, And PE needs to be grounded.
8. Optional customer supplied 110 VAC, 25 VA maximum coil rated chilled water pump relay (EP1 & 2) can be wired as shown. This option will cycle the chilled water pump in response to building load.
9. The condenser water pump must cycle with the unit. Customer supplied 110VAC, 25 VA maximum coil rated condenser water pump relay (CP1 & 2) is to be wired as shown.
10. Optional customer supplied 110VAC, 25 VA maximum coils rated cooling tower fan relays (C1-C4) can be wired as shown. This option will cycle the cooling tower fans in order to maintain unit head pressure.
11. The 24 VAC auxiliary contacts of cooling water pump and chilled water pump starters shall be wired as shown in the figure.

7. Operation of HMI

7.1 Responsibility of Operator

It is important that the operator become familiar with the equipment and the system before attempting to operate the chiller. Please read Operating Manual and unit control schematic diagram and related document first.

During the initial startup of the chiller, the DAIKIN technician will be available to answer any questions and instruct in the proper operating procedures.

It is recommended that the operator maintain an operating log for each individual chiller unit. In addition, a separate maintenance log should be kept of the periodic maintenance and servicing activities.

The DAIKIN centrifugal water chiller shall be maintained within good operating state for it's expensive. Any abnormal or rare conditions of chiller shall be reported to the technical personnel of DAIKIN service technicians.

DAIKIN offers some factory training for DAIKIN centrifugal operators every year, and training course includes instruction on basic refrigeration, MicroTech controllers, enhancing chiller efficiency and reliability, MicroTech troubleshooting, system components, and other related subjects. Further information please contacts local DAIKIN.

7.2 Compressor Operation

The HXE compressors are two-stage. Suction gas enters the compressor through inlet guide vanes that can be opened and closed to control refrigerant flow as the cooling load changes. The suction gas enters the first stage impeller, is compressed, and travels through the vanned radial diffuser to the second stage impeller where compression is completed. The gas travels to the condenser via the discharge volute, which converts any remaining velocity pressure to static pressure.

Motor cooling is accomplished by utilizing the refrigerant effect of high-pressure liquid refrigerant from the condenser expanded to a gas within the compressor. The refrigerant cools VFD heat sinks and the motor.

Magnetic bearing system supports the motor/compressor shaft, resisting radial and thrust forces. The bearing control system uses shaft position feedback to continually adjust the bearing to keep the shaft in the correct position. In the event of a power failure, the compressor motor acts as a generator and powers the bearing support system during coast down. There is also a system to gently de-levitate the shaft.

Many controls are mounted directly on the compressor where they monitor and control compressor operation. These compressor controls are interfaced with the conventional MicroTech controls to provide a complete chiller control system.

Daikin Service can connect laptop and J7 port on the I/O board by the USB to RS232 cable, please see the figure 7-1.

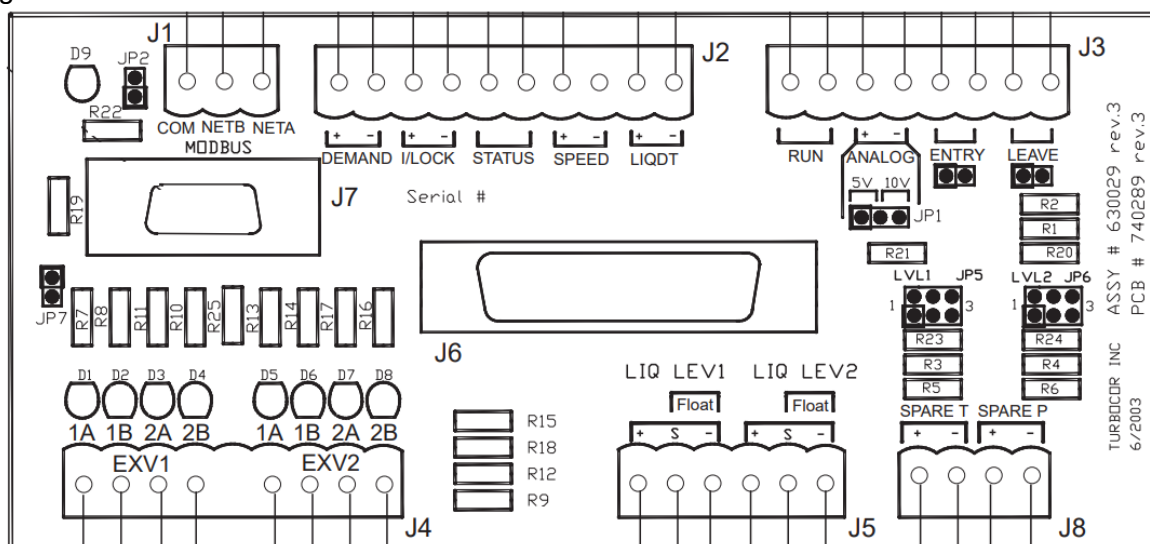


Fig 7-1

Open the software named Service Monitoring Tools, select the port which can be used to connect the compressor, then input applicable password, and see the figure 7-2.

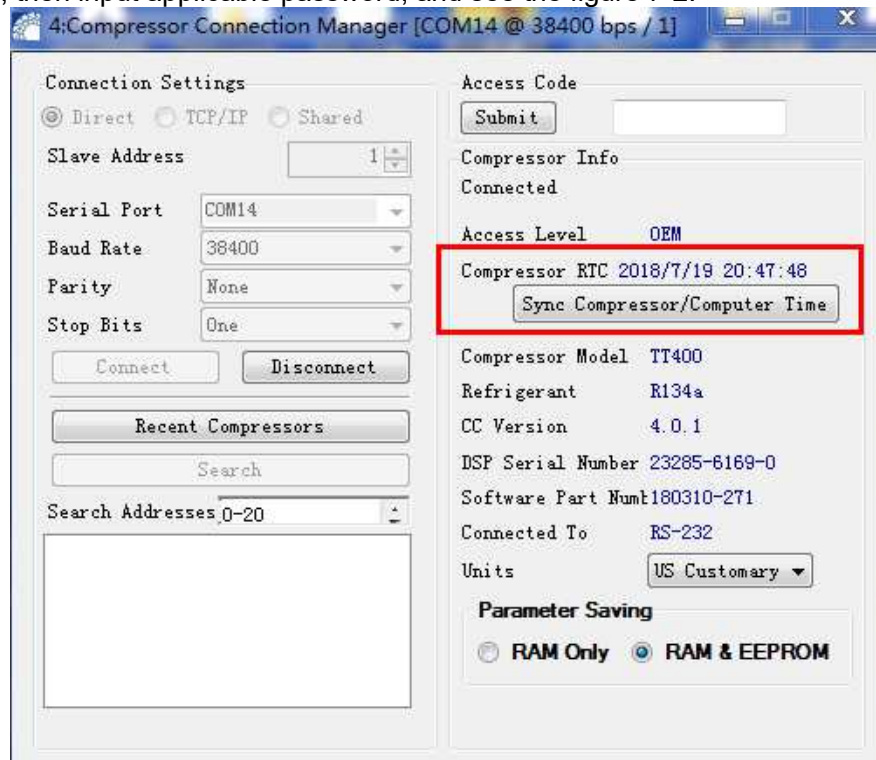


Fig 7-2

If the time of compressor is different from the active time now, press the button” Sync Compressor/Computer Time”, then time will be synchronized.

7.3 MicroTech Control

HXE chillers are equipped with the DAIKIN MicroTech control system which contains all monitoring and control functions and demand of water chiller and microprocessor for ensuring its effectively operation. The control systems consist of:

- Human-Machine Interface: an input device for configuring the information and main parameters for each chiller. The screen is free of control function.
- Large controller: control function and all other control communication for each water chiller. The screen can be used to input parameters set value when it's not working. It is installed in the control box.

Notes: Operating instructions for the MicroTech controller are contained in Operating Manual.

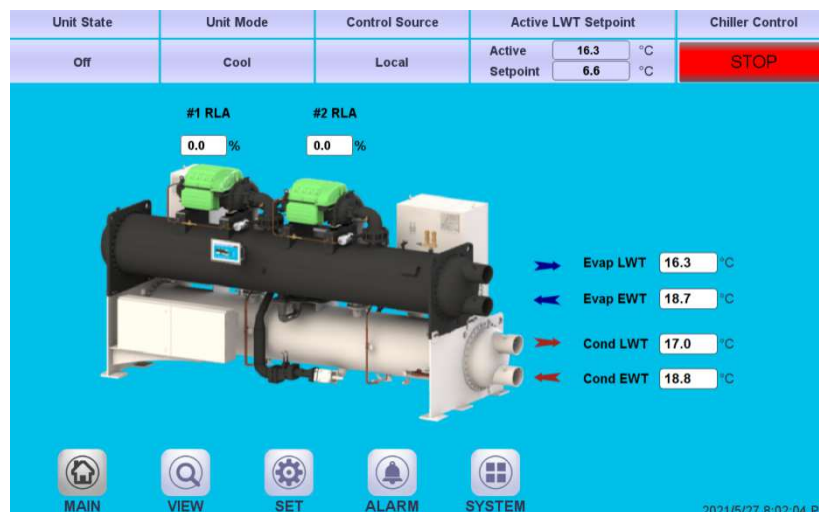


Fig. 7-3 12' Micro-Tech screen



Fig. 7-4 15' Micro-Tech screen

8. Confirmation before Test Run

Please confirm the following items before test run to keep personnel and equipment safe:

8.1 Check whether the power circuit is connected correctly.

Wiring

Important Notes:

Voltage unbalance that exceeds 2% with a resultant current unbalance of 6 to 10 times the voltage unbalance.

The type of power supply must meet the requirements of relevant standards. The maximum voltage fluctuation range is $\pm 10\%$ of the rated voltage of the unit, and the grid frequency fluctuation range is $\pm 1\%$ of the rated frequency. The voltage difference between any two phases of the power supply must be less than 2% of the average voltage, and the voltage harmonic distortion rate is $\leq 5\%$.

Wiring might have risk of electric shock. The operator must have been certificated.

Power wiring to compressors must be in proper phase sequence. Motor rotation is set up for clockwise rotation facing the lead end with phase sequence.

Wiring for Optional BAS Interface

The optional Building Automation System (BAS) interface utilizing the MicroTech controller's protocol select ability feature is field wired and will be set-up by the DAIKIN startup service technician.

Control Panel switch

Several On/Off switches are located in the left bottom corner of the main Unit Control Panel. The functions are as below:

- Unit switch: shuts down the chiller through the normal shutdown cycle of unloading the compressor(s) and provides a post-lube period.
- Compressor switch: one switch for each compressor on a unit, executes an immediate shutdown without the normal shutdown cycle.

Another switch located on the right outside of the Unit Control Panel and labeled COMPRESSOR On/Off SWITCH to stop the compressor immediately.

8.2 Confirmation to starting power on.

Equipment room temperature in the standby state

-Water in vessels: 0°C to 50°C

-Without water in vessels: -18°C to 60°C

-Temperature in the marine tank and vessel without water: -18°C-54.4°C

Equipment room temperature, operating: 3°C to 40°C

Nameplate (terms)

There is a group of code in the nameplate of each HXE chiller to describe characteristics of chiller and differences between different chillers. The nameplate is installed at one side of chiller's control box. On it, there is sculpted with model and serial number which are uniquely assigned to each chiller, and they could provide identification for chiller during its running or while other problems occur. Additionally, the information of refrigerant charging volume is included on the nameplate. Nameplates for large composites of chiller are also equipped for providing necessary information to installers and operators.

The compressor, of which the model is designated as TG, is adopted for all HXE chillers. Information of model, type and code of the compressor and the electrical characteristics of compressor motor can be referred from the nameplate.

Nameplates of both condenser and evaporator include information of maximum working pressure, code and type of vessel.

8.3 Confirmation of the Water System

Under the circumstance that the compressors suffering no surge or loss of control, it takes a certain time for all water systems of the water chillers to bring themselves from having identified the load change to stabilizing the running. In the air-conditioning system, a surge may occur to the compressor while the cooling capacity required by structure lowers to be below the chiller's minimum load or the water flow in the closed system is very small.

A water storage tank of a proper size shall be provided if the volume of water provided by customer's water system fails to meet the water circulating volume requirements, a water storage tank of a proper size shall be provided.

During chiller operation, it is required to ensure that the fluctuation rate of cooling water inlet temperature is less than 30% * (the temperature difference between inlet and outlet of condenser under full load condition) per minute.

Water pump

Operation of the chilled water pump can be to 1) cycle the pump with the compressor, 2) operate continuously, or 3) start automatically by a remote source.

The cooling tower pump must cycle with the machine. The holding coil of the cooling tower pump motor starter must be rated at 110 volts, 50 Hz, with a maximum volt-ampere rating of 100. A control relay is required if the voltage-ampere rating is exceeded. See the Field Wiring Diagram or in the cover of control panel for proper connections.

All interlock contacts must be rated for no less than 10 inductive amps. The alarm circuit provided in the control center utilizes 110-volts AC. The alarms must not draw more than 10-volt amperes.

Refer to of chiller Control in the Operating Manual of MicroTech for details.

Drainage of chiller when starting up

The chiller shall be drained thoroughly before ex-factory and its plug screw or ball valve on the draining shall keep open throughout transportation course. Ensure that the plug screw is screwed tight or close the ball valve before charging fluid into the vessel of chiller.

Water circuits of evaporator and condenser

The evaporator and condenser of all HXE Series water chillers are connected by clamps or flanges. The installer must provide corresponding connection method according to requirements of system size and contents gauge.

Items to be noted while welding

Notes: Water switches and sensors on connecting pipes shall be removed while welding pipe connectors to prevent them from being damaged. Place the chiller properly and keep the controller of MicroTech chiller away from damage.

Each water entering and leaving water pipe on vessel water cover is equipped with a plug screw which is provided to connect the test equipment (the position of the plug screw is determined by the plant as per the customer's design); connect the water entering and leaving pipes of the condenser according to drawing requirements and signs on pipes.

Upper and lower parts of vessel water cover are equipped with plug screws. The plug screw on the upper part is provided for emptying air inside the vessel (while water pump is operating) by following the method: slowly screw the plug screw to exhaust air until see water projecting out which indicates the exhaustion of air. Please be noted that the plug screw shall not be screwed off from the cover. The plug screw on the lower part is provided for drainage. After long-term stopping, the water in the vessel of chiller shall be dewatered thoroughly by screwing off the plug screw on the bottom, and, meanwhile, loosen the upper plug screw to let air in for balancing the pressure inside the vessel so that the water can be fully drained.

A proper support shall be applied for the entering & leaving water pipes of the vessel to relieve the pressure withstood by the connection part. The water circuit pipeline of evaporator shall be wrapped with thermal insulation materials; a filter shall be installed at each of the entering water point, and enough stop valves shall be provided for fully exhausting the water accumulated in the vessel.

Flow control

Install a flow switch for each of the leaving water pipe of chiller to ensure that there is sufficient water can inflow or outflow the vessel before starting chiller. The installed switch shall be able to be switched off in case that water is cut off, so that the evaporator can be protected from being frozen and against occurrence of low pressure. HXE chillers adopts thermal flow switch as its standard configuration, and its internal wiring is completed during manufacture. If customer use target flow switch, it must be field wired.

Cooling tower

The condenser water flow rate must be checked to be sure that it conforms to the system design. Daikin suggest customer install the condenser entering temperature auto controller. If cooling tower do not have this function, then the tower bypass valve controlled by the unit controller is required. Unless the system and chiller unit are specifically designed for them, condenser bypass or variable condenser flow is not recommended, since low condenser flow rates can cause unstable operation and excessive tube fouling.

The condenser water pump should synchronize with the chiller.

Condenser Water Temperature

When the ambient wet bulb temperature is lower than design, the entering condenser water temperature can be allowed to fall to improving chiller performance.

For example, when the target of evaporator leaving temperature is 6.7°C, HXE chillers allow condenser entering water temperature as low as 12.8°C.

But on the other hand, lower condenser entering water temperature means more power consumption of cooling tower. When chiller is running at low load, the power consumption of the cooling tower may occupy large proportion in total system. In this case, the efficiency of the total system is not the best even chiller has very high COP.

According to this condition, we suggest customer using cooling tower fan control. And when the environment temperature is lower, the condenser entering water temperature will lower than 12.8°C and even lower than the evaporator entering temperature. In this case, cooling tower bypass is very important for the system.

The following figure shows the typical temperature-actuated tower bypass arrangements. When the environment temperature is lower, open the three-way-valve to make sure the condenser entering water temperature in a certain condition.

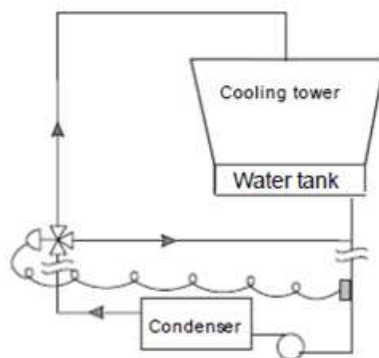


Fig. 8-1

8.4 Confirmation of Chiller

Open the valves in the refrigerant circulation loop

There are several stop valves installed at the refrigerant loop to facilitate maintenance. All of these valves must be open during operation of chiller.

Table 8-1

Installation Location	Valve Type	Quantity of Compressor Used Single/Double/Triple/ Quadri
Compressor Suction Line	Manual Butterfly Valve	1/2/3/4
Main Feed Flow	Right Angle Stop Valve	1
Motor Cooling Pipe	Ball Valve	2/4/6/8

Drainage valve and emptying valve are shut down.

Open water system valve

Open the water valves of the evaporator and the cooler; check whether there is any water leakage at each connection point.

Start the water pump and the fan of cooling tower

Set up required chilled water flow, cooling water flow and leaving water control temperature of chilled water and entering water control temperature of cooling water according to the parameters data of chiller through the control console. Start the chilled water pump, cooling water pump, cooling tower water pump and cooling tower fan after confirming the set parameters are in line with the required parameters. Control system will control the flow and temperature according to the set state point. If the conditions cannot be met, manual adjustment may be applied.

Verification of control parameters of chiller

Correct control parameters guarantee normal operation of chiller.

Shutdown due to low suction pressure	106.2kPa
Unloading due to low suction pressure	111.0kPa
Limit increased load due to low suction pressure	117.2kPa
Shutdown due to high discharge pressure	834kPa

Maximum rate of temperature fall	0.3°C-1.5°C
Minimum rate of temperature fall	0.1°C-1.0°C
Shutdown due to high temperature of exhaust gas	88°C

Other parameters can be set to the default values of the control. All the control parameters have been confirmed before shipping, customer do not need to change the set point unless necessary.

All the parameters above are suitable for standard condition. Nonstandard chiller may have different set point. Contact DAIKIN to get more information about the parameters.

8.5 VFD Line Harmonics

Despite their many benefits, care must be taken when applying VFDs due to the effect of line harmonics on the building electric system. VFDs cause distortion of the AC line because they are nonlinear loads, that is, they don't draw sinusoidal current from the line. They draw their current from only the peaks of the AC line, thereby flattening the top of the voltage waveform. Some other nonlinear loads are electronic ballasts and uninterruptible power supplies.

Line harmonics and their associated distortion can be critical to ac-drives for three reasons:

1. Current harmonics can cause additional heating to transformers, conductors, and switchgear.
2. Voltage harmonics upset the smooth voltage sinusoidal waveform.
3. High-frequency components of voltage distortion can interfere with signals transmitted on the AC line for some control systems.

Current Harmonics improvement

An increase in reactive impedance in front of the VFD helps reduce the harmonic currents. Reactive impedance can be added in the following ways:

1. Mount the drive far from the source transformer.
2. Add line reactors. They are standard equipment on HXE chillers.
3. Use an isolation transformer.
4. Use a harmonic filter.

Voltage Harmonics improvement

Voltage distortion is caused by the flow of harmonic currents through source impedance. A reduction in source impedance to the point of common coupling (PCC) will result in a reduction in voltage harmonics. This can be done in the following ways:

1. Keep the PCC as far from the drives (close to the power source) as possible.
2. Increase the size (decrease the impedance) of the source transformer.
3. Increase the capacity (decrease the impedance) of the busway or cables from the source to the PCC.
4. Make sure that added reactance is "downstream" (closer to the VFD than the source) from the PCC.

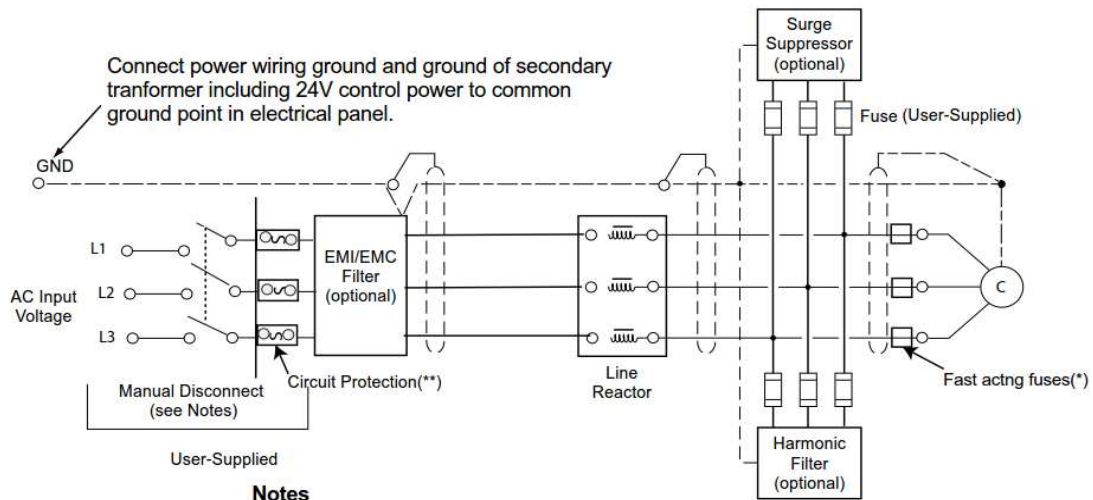
Line Reactors

Line Reactors are standard equipment on HXE chillers and located in the starter. They are employed to improve the power factor by reducing the effects of harmonics.

Harmonic filter

The harmonic filter is an option for field mounting and wiring outside of the power panel. It works in conjunction with the line reactor to further minimize harmonic distortion. It is wired between the line reactor and compressor. IEEE 519-1991 Standard defines acceptable limits.

Typical power line wiring diagram of HXE is shown in the figure below.



Notes

(*) Fast acting fuses must be installed for the TT350, TG310, TT400 and TT500 models. The TT350, TT400 and TT500 use Class T 600VAC fast-acting fuses. The fuses are built into the TT300.

(**) Circuit protection is required, according to local electrical requirements.

Fig. 8-2

8.6 Prestart System Checklist

Chilled Water	Yes	No
Piping complete.....	☐	☐
Water system filled, vented.....	☐	☐
Pumps installed, (rotation checked), strainers cleaned.....	☐	☐
Controls (3-way, face and bypass dampers, bypass valves, etc.) operable.....	☐	☐
Water system operated and flow balanced to meet unit design requirements.....	☐	☐
Condenser Water		
Cooling tower flushed, filled and vented.....	☐	☐
Pumps installed, (rotation checked), strainers cleaned.....	☐	☐
Filter has been installed at entering position of the cooling tower.....	☐	☐
Controls (3-way, bypass valves, etc.) operable.....	☐	☐
Water system operated and flow-balanced to meet unit requirements.....	☐	☐
Electrical		
The chain wiring of HMI and qualified pump starter has been completed.....	☐	☐
Power leads connected to the unit power panel(s).....	☐	☐
The cabinet conforms to the manual.....	☐	☐
Pump starters and interlock wired.....	☐	☐
Cooling tower fans and controls wired.....	☐	☐
Wiring complies with National Electrical Code and local codes.....	☐	☐
Condenser pump starting relay (CWR) installed and wired.....	☐	☐
Miscellaneous		
Relief valve piping complete.....	☐	☐
Thermometer wells, thermometers, gauges, control wells, controls, etc., installed.....	☐	☐
Minimum system load of 80% of machine capacity available for testing.....	☐	☐

Note: This checklist must be completed and sent to the local DAIKIN Factory Service location two weeks prior.

9.Operation Mode

9.1 During the First Operation

The chiller shall be operated and watched during its first operation.

Power the chiller: while outputting power to the chiller, ensure that the circuit switches of the starter and control box are disconnected. Close the upstream switch of the starter, then, measure the voltage at any two of the three phases with a voltmeter to check whether the voltage have reached to the rated voltage. After it has been confirmed as correct, close the power supply switches of the incoming wire of the starter, check whether the reading of starter voltmeter is in line with the actual voltage, and inspect whether the voltage of the two ends of wiring terminal L1 and L2 of control box is the same with the diagram or not with a voltmeter. After the voltage has been confirmed as correct, close the switch of the control box and observe whether the network communication and data of chiller control and compressor control are normal. If there is any abnormality, an inspection and calibration shall be perform according to the update circuit drawing provided by department of technology.

All compressors on the chiller must be energized for at least 24 hours before starting the compressor.

The operations mentioned above shall be performed for the chiller at its first operation after long term stop.

10.Functions of Chiller

10.1Motor Overheating Protection

The compressor controller is equipped with motor & VFD protection plate. If motor or VFD temperature rise above to risk value, compressor will stop and send the alarm to HMI.

10.2Chiller Stop Alarm

1) Temperature sensors and pressure sensors are installed in every area wherever there are pipes lying. These sensors can provide temperature and pressure information of the pipes for judging the operation condition of the chiller.

Table 10-1

Temperature Sensor	Pressure Sensor
Economizer Temperature	Discharge pressure
Evaporator entering water temperature	Economizer pressure
Evaporator leaving water Temperature	Middle pressure
Condenser entering water temperature	Suction pressure
Condenser leaving water Temperature	

2) Description of chiller shutdown with check valve alarm

For multi-compressors chiller, when the chiller is shut down due to the check valve failure alarm, please immediately close the suction butterfly valve of the corresponding failed compressor to avoid damage to the compressor caused by refrigerant backflow. Please do not power off and restart, and contact the local service for handling.

10.3 Relief Valve

As a safety precaution and to meet code requirements, each chiller is equipped with pressure relief valves located on the condenser and evaporator for the purpose of relieving excessive refrigerant pressure to the atmosphere.

1) Dual relief valve design, adjust the three way stop valve rod, make sure one valve could working when the other is in maintenance.

Note: when three-way stop valve rod adjust to the right, No.1 valve is open, when adjust valve rod to left, No 2 valve is open.

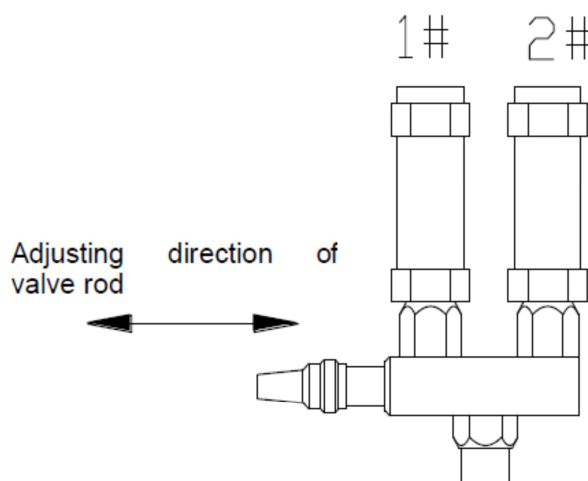


Fig. 10-1

2) Single relief valve design, chiller operation need to confirm the special ball valve open and no damage. When the relief valve is being repaired, you need to close the ball valve, replace the relief valve and then open the ball valve. The specific structure and operation diagram are as follows,

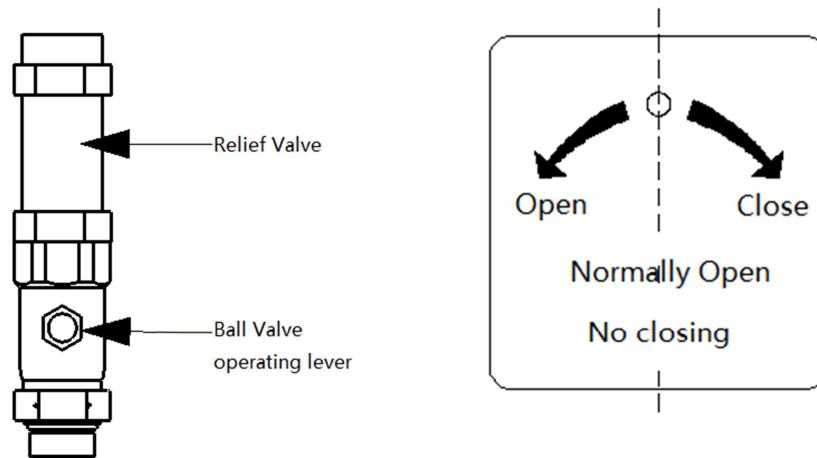


Fig. 10-2

3) Here on the relief valve, an emptying pipe shall be installed as leading to the outdoor space if required by local laws and regulations. Pipe used for connecting the relief valve must be equipped with flexible connector. Typical emptying pipe is shown in the figure below.

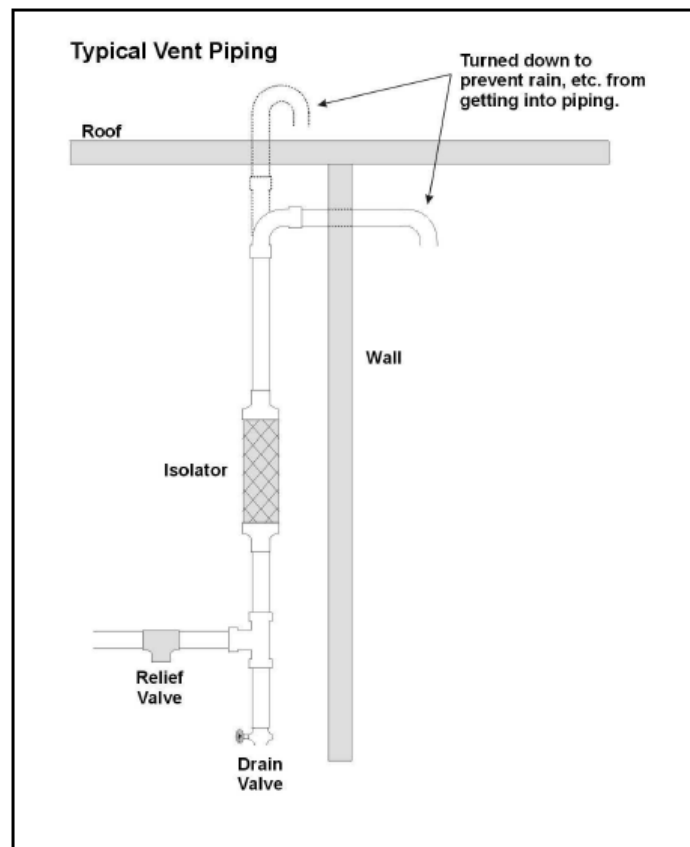


Fig. 10-3

Note: Remove plastic shipping plugs (if installed) from the inside of the valves prior to making pipe connections. Whenever vent piping is installed, the lines must be run in accordance with local code requirements.

When install discharge pipe on relief valve, the size of discharge pipe selection as per the size of relief

valve, then connect to the two valves.

These pipes must be installed in a way that ensures that people and property are not exposed to refrigerant leaks. These fluids may be diffused in the air, but far away from any building air intake, or they must be discharged in a quantity that is appropriate for a suitably absorbing environment (Note that the R1234ze(E) refrigerant is heavier than air).

10.3.1 Refrigerant Vent Piping

Relief valve connection size is FNPT 1 for HXES/HXED/HXET/HXEQ.

- 1) Dual relief valves mounted on a transfer valve are used so that one relief valve can be shut off and removed, leaving the other in operation. Replace the bad one at the same time.
- 2) Single relief valve design, chiller operation need to confirm the special ball valve open and no damage. When the relief valve is being repaired, you need to close the ball valve, replace the relief valve and then open the ball valve.

10.3.2 Refrigerant discharge pipe specification

Set the relief valve pressure of DAIKIN centrifugal chiller to 200 PSI (1380kPa)

Table 10-2

chiller	Relief Valve	Installation Location	Pressure Setting	Exhaust Capacity (air)
HXEM HXES HXED	Evaporator	Top of Evaporator	200PSI	34.2kg/min
HXET HEXQ	Condenser	Top of Condenser	200PSI	34.2kg/min

The diameter of relief valve pipe must bigger than 22mm. If the pipe is too long or has too much turning, the diameter of this pipe must even bigger. If the length of the pipe reaches 32m, the diameter of the pipe must double bigger at least. The pipe and the relief valve must connect by reducer.

Note:1 inch pipe is too small for the fluid from the valve. The reducing tube must be connected on the valve outlet.

Collective pipe

The discharge from more than one relief valve can be run into a collective pipe, the area of which cannot be less than the sum of the areas of the connected pipes. The diameter of the collective pipe can be calculated by the formula:

$$D_{Common} = \left(D_1^2 + D_2^2 + \dots + D_n^2 \right)^{0.5}$$

Where, D1, D2, Dn etc. stand for diameters of each branch pipe respectively.

Inspection

DAIKIN requires that the safety valve be calibrated before the chiller is used (Safety valve calibration shall be in accordance with local regulations), Inspect relief valves at least once a year. And it should be done by the professional person(If there are local regulations, please follow the local regulations). Replace relief valve if corrosion or rust or grease stain is detected inside and outside of the valve. Specific inspection methods can be referred to the local stipulations. Inspection contents include:

- 1) Whether the safety valve is within the validity period of calibration. If it is not within the calibration period, the safety valve shall be sent to the safety valve calibration Organization (generally the quality and Technical Supervision Bureau in the place where the equipment is located) for re calibration;
- 2) Whether the lead seal of safety valve is intact. If the lead seal is damaged, the safety valve shall be

sent to the safety valve calibration Organization (generally the quality and Technical Supervision Bureau in the place where the equipment is located) for re calibration;

3) Whether the switching valve between the safety valve and the pressure vessel is in the full open position. If not, it is necessary to adjust the switch valve to the full open position to ensure that there is sufficient discharge channel;

4) Check whether the safety valve leaks. If any, the safety valve of the same model and specification shall be replaced;

5) Whether there are corrosion, rust and other factors affecting the action of safety valve inside and outside the safety valve. If any, the safety valve of the same model and specification shall be replaced.

6) During the calibration of the safety valve, it is recommended to use a plug to block the threaded joints on the three-way valve where the safety valve is not installed, and perform a leak check to ensure that there is no leakage.

Pressure vessel registration and inspection

The registration and inspection of pressure vessels should comply with local laws and regulations

10.4 Variable Frequency Driver

All HXE chillers have VFD function.

VFD and IGV (inlet guide vane) control the chiller jointly. The logic is like this: Chiller will first slow down the compressor on the premise of enough pressure ratio when the load is decreasing. Only if the RPM of the compressor can't decrease, the IGV will close to reduce the capacity. This logic helps chiller always running at the most efficient mode.

In addition, VFD helps chiller has minimum start current, so that HXE chillers will not influence the customer's power supply system when starting.

11.Maintenance

11.1 Temperature/Pressure Chart

Table 11-1

Temperature and Pressure Corresponding Table under Saturation Condition of R1234ze(E)							
°C	kPa	°C	kPa	°C	kPa	°C	kPa
-15	19	7	177	29	460	51	922
-14	24	8	187	30	477	52	948
-13	29	9	197	31	494	53	974
-12	35	10	207	32	511	54	1001
-11	40	11	218	33	529	55	1029
-10	46	12	229	34	547	56	1057
-9	52	13	240	35	566	57	1086
-8	58	14	251	36	585	58	1115
-7	65	15	263	37	604	59	1145
-6	71	16	275	38	624	60	1175
-5	78	17	287	39	644	61	1206
-4	85	18	300	40	665	62	1237
-3	92	19	313	41	686	63	1269
-2	100	20	326	42	708	64	1302
-1	107	21	340	43	730	65	1335
0	115	22	353	44	752	66	1369
1	123	23	368	45	775	67	1403
2	132	24	382	46	798	68	1438
3	140	25	397	47	822	69	1474
4	149	26	412	48	846	70	1510
5	158	27	428	49	871	71	1546
6	167	28	444	50	896	72	1584

Notes: all the pressures in the table above are relative pressures.

11.2 Routine Maintenance of Protection Devices

Maintain protection devices regularly and record results according to local regulations.

The machine may be damaged if the protection devices are incorrectly confirmed.

11.3 Pre-maintenance

- Contact with other maintenance managers before maintenance.
- See Chapter IV for [About Safety] and confirm again.
- In the remote operation – choose the “Local” on the touch panel to prevent the chiller from running when remote signal is input.
- Put “Chiller in Maintenance” warning signs on the chiller control box (electronic control box) and the remote control device to ensure safety.

11.4 Routine Maintenance

Refrigerant Cycle

Maintenance of the refrigerant cycle includes maintaining a log of the operating conditions and checking

that the unit has the proper refrigerant charge.

At every inspection, the suction, and discharge pressures should be noted and recorded, as well as condenser and chiller water temperatures and pressure drops.

The superheat of suction line and discharge line should be taken at least once a month. For HXE chillers, every compressor has the superheat and this data can copy from the HMI directly. In general, the superheat of suction line can be 0.3 °C-1.2 °C and the superheat of discharge line can be 3 °C-7 °C at the full load.

When working on the refrigeration system, pay attention to first the pressure to 0, to avoid personal injury.

Electrical System

Maintenance of the electrical system involves the general requirement of keeping contacts clean and connections tight and checking on specific items as follows:

1. The compressor current draw should be checked and compared to nameplate RLA value. Normally, the actual current will be lower, since the nameplate rating represents full load operation. Also check all pumps and fan motor amperages, and compare with nameplate ratings.
2. At least once a quarter, all equipment protection controls, except compressor overloads, should be made to operate and their operating points checked. A control can shift its operating point as it ages, and this must be detected so the controls can be adjusted or replaced. Pump interlocks and flow switches or differential pressure switches should be checked to be sure they interrupt the control circuit when tripped.

11.5 About Refrigerant

Refrigerant Charge

The chiller leak detection has been done before shipping and sufficient refrigerant has been charged and the refrigerant charge has been marked on the nameplate. If refrigerant R1234ze(E) is to be added because of shipping damage, repair the leak area or recharge the refrigerant after vacuum.

1. Use hose connection connects the refrigerant tank and the refrigerant port of the stop valve which is located on the liquid pipe. Open the valve on the refrigerant tank slightly to use refrigerant eliminate air in the hose connection. Then open the stop valve to charge the refrigerant to chiller.
2. Open the chill water pumps and cooling water pump before charging to prevent frozen.
3. At the beginning of the charging, the chiller is vacuum so that we can erect the refrigerant tank, then liquid refrigerant can be sucked to the chiller from the tank. As the refrigerant will increase the inside pressure of the chiller, the pressure difference between refrigerant tank and the chiller will decrease and balance at last. At this moment we can heat the refrigerant tank slightly to increase the inside pressure of the tank. This may benefit for refrigerant charging.
4. The other way to charge the refrigerant is to increase the height of the tank. Lift the refrigerant tank above the condenser so the liquid refrigerant will flow into the condenser under the action of gravity.
5. If above 75% of the refrigerant has been charged to the chiller, the refrigerant in the tank can hardly be charge to chiller. In this case, connect the hose connection between tank and evaporator, then start the compressor, the refrigerant in the tank will be sucked to the chiller as the evaporator has lower pressure.

Warning: Recheck the chiller when refrigerant charge is finished.

11.6 Cleaning and Maintenance

The dirty system may cause chiller's fault, so routine maintenance is indispensable.

Reasons of dirty system:

1. Eliminate the perpetual dirt and the dirt in water filter, this maintenance should refer to the IOMM of the chiller. The disposable filter must be replaced every time and the frequency of the maintenance must depend on the actual operation state.
2. Rinsing the chilled water filter and cooling water filter when checking the system.

Replacement of Relief Valve

1) Dual relief valves design, all the vessels of WXE chillers have two relief valves. One is working and the other standby. This helps reducing the difficulty of maintenance. The method of relief valve showed at the 10.3 section. If one of the relief valves needs to replace, follow the following method:

If the relief valve which is closest to the valve stem is leaking, back-out the valve rod fully until the leaking relief valve has been shut off. Remove and replace the leaking relief valve. The three-way valve should always shut off among the replacement operation. If the relief valve which is far from the valve rod is leaking, screw in the valve rod fully to replace it.

2) Single relief valve design, all the vessels of WXE chillers have one relief valve. The method of relief valve showed at the 10.3 section. If the relief valve needs to replace, follow the following method:

Close the ball valve, replace the relief valve, and open the ball valve to full open position.

Pumping down

If it becomes necessary to pump the system down, extreme care must be used to avoid damage to the evaporator from freezing. Always make sure that full water flow is maintained through the chiller and condenser while pumping down. To pump the system down, close all liquid line valves. With all liquid line valves closed and water flowing, start the compressor. Set the MicroTech controller to the manual load. The vanes must be open while pumping down to avoid a surge or other damaging condition. Pump the unit down until the MicroTech controller cuts out at approximately 20 psig. It is possible that the unit might experience a mild surge condition prior to cutout. If this should occur, immediately shut off the compressor and pump it into the condenser or pump-out vessel using approved procedures.

Pressure Testing

No pressure testing is necessary unless some damage was incurred during shipment. Damage can be determined by a visual inspection of the exterior piping, checking that no breakage occurred or fittings loosened. Service gauges should show a positive pressure. If no pressure is evident on the gauges, a leak may have occurred, discharging the entire refrigerant charge. In this case, the unit must be leak tested to determine the location of the leak.

Leak Testing

In the case of loss of the entire refrigerant charge, the unit must be checked for leaks prior to charging the complete system. This can be done by charging enough refrigerant into the system to build the pressure up to approximately 10 psig (69 kPa) and adding sufficient dry nitrogen to bring the pressure up to a maximum of 125 psig (860 kPa). Leak test with an electronic leak detector. Halide leak detectors do not function with R134a. Water flow through the vessels must be maintained anytime refrigerant is added or removed from the system.

Notes: Do not use the refrigerant and air mixture or oxygen to raise the pressure to prevent explosion.

In the event of using the pressure regulating valve to establish a system pressure, keep the pressure within the given test pressure above. The air supply pipeline shall be cut when the pressure reaches the test pressure.

If there is a leak on the weld seam or the brazing position, or a washer replacement is needed, it is necessary to release the system test pressure before treatment. The brazing process is necessary for the copper pipe joint.

After the overhaul, the vacuum-pump is required by the following procedures.

Evacuation

For the convenience of compressor repair, all the DAIKIN centrifugal water chillers in design allow for the pump of the refrigerant to the condenser. The suction stop valves installed in HXED and HXET chillers, which, if installed, also allow for the pump of the refrigerant to the evaporator.

If no leak point is found after detection, vacuum pump the chiller with vacuum pump, the vacuum-pump capacity of which should reach 67Pa. The pressure gage or piezometer must install distant from the vacuum pump to get the actual vacuum of the chiller.

If 67 Pa cannot be gained by the vacuum-pump, run the vacuum-pump 3 times. After the first

vacuum-pump, the categorical pressure is about 10kPa and then charge the dry nitrogen into the system to raise the categorical pressure of the system to 100kPa. Repeat the operation 3 times to get the vacuum.

12. Off-season Precautions

In the case of off-season, ensure the power is cut off.

The following maintenance is mandatory before off-season and restart.

If the chiller is shut down for a long time (more than 3 months) or stored in an environment with humidity equal to or greater than 85% for a long time (more than 24 hours), take the following precautions before ordering the compressor to run.

- Before powering on the chiller, visually inspect the top electronics to ensure that there are no signs of oxidation or any other signs of moisture or condensation.
- Ensure compressor all cover plate are put in place and be fixed.
- All compressors on the chiller must be energized for at least 24 hours before starting the compressor.

12.1 Annual Shutdown

Where the chiller can be subject to freezing temperatures, the condenser and evaporator must be drained of all water. Dry air blown through the condenser will aid in forcing all water out. Make sure there is no oil in the dry air otherwise "ant-nest-corrosion" will damage the tubes. Removal of condenser heads is also recommended. The condenser and evaporator are not self-draining and tubes must be blown out. Water permitted to remain in the piping and vessels can rupture these parts if subjected to freezing temperature.

Forced circulation of antifreeze through the water circuits is the reliably method for avoiding freeze up.

1. Take measures to prevent the shutoff valve in the water supply line from being accidentally turned on.
2. If a cooling tower is used and if the water pumps will be exposed to freezing temperature, be sure to remove the pump drain plug and leave it out so any water that can accumulate will drain away.
3. Open the compressor disconnect switch. Set the manual COMPRESSOR and UNIT ON/OFF switches in the Unit Control Panel to the OFF position.
4. Check for corrosion and clean and paint rusted surfaces.
5. Clean and flush water tower for all units operating on a water tower.
6. Remove condenser heads at least once a year to inspect the condenser tubes and clean if required.

12.2 Annual Startup

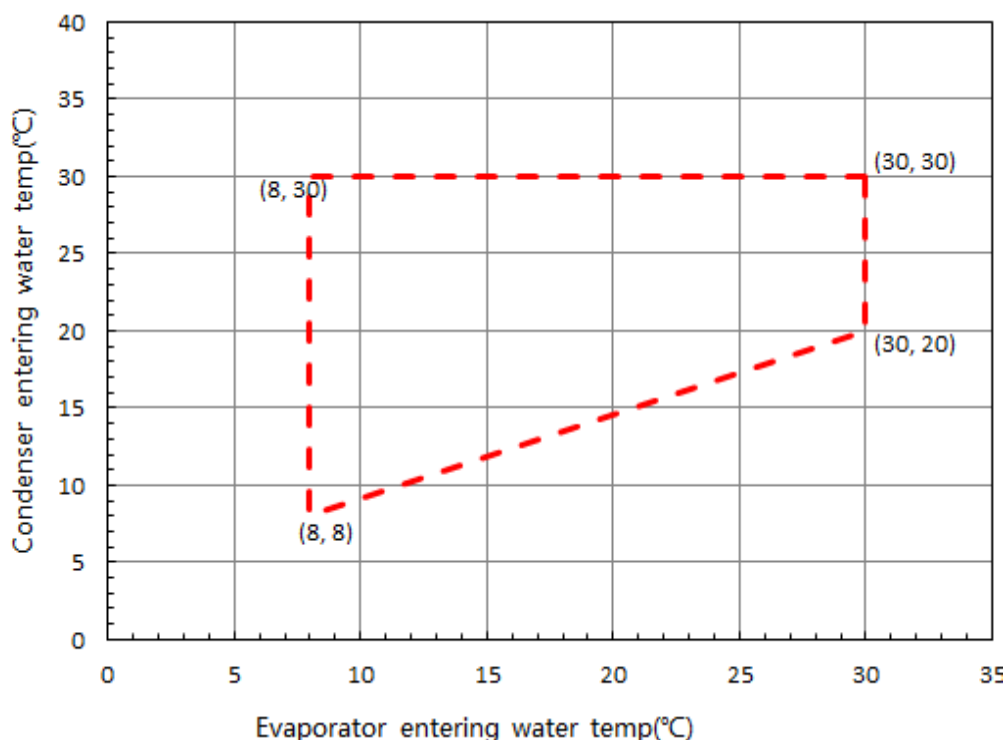
If the chiller starter has been damaged, the power supply can lead to dangerous. For machinery and equipment are not familiar with boot, boot accident occurs, so, when the phone is switched on to review it.

All motor coil grounding resistance needs to be checked, every six months and docking ground resistance value check detailed record, because the resistance value will reflect the aging of the coil insulation. New electrical wiring of the unit and the resistance value are between the 10 M Ω .

Once reading changed or average reading value is less than 5 M Ω , need to check the chiller before the unit start. Check the motor timely can protect the chiller and avoid the system cleaning work caused by motor burn down.

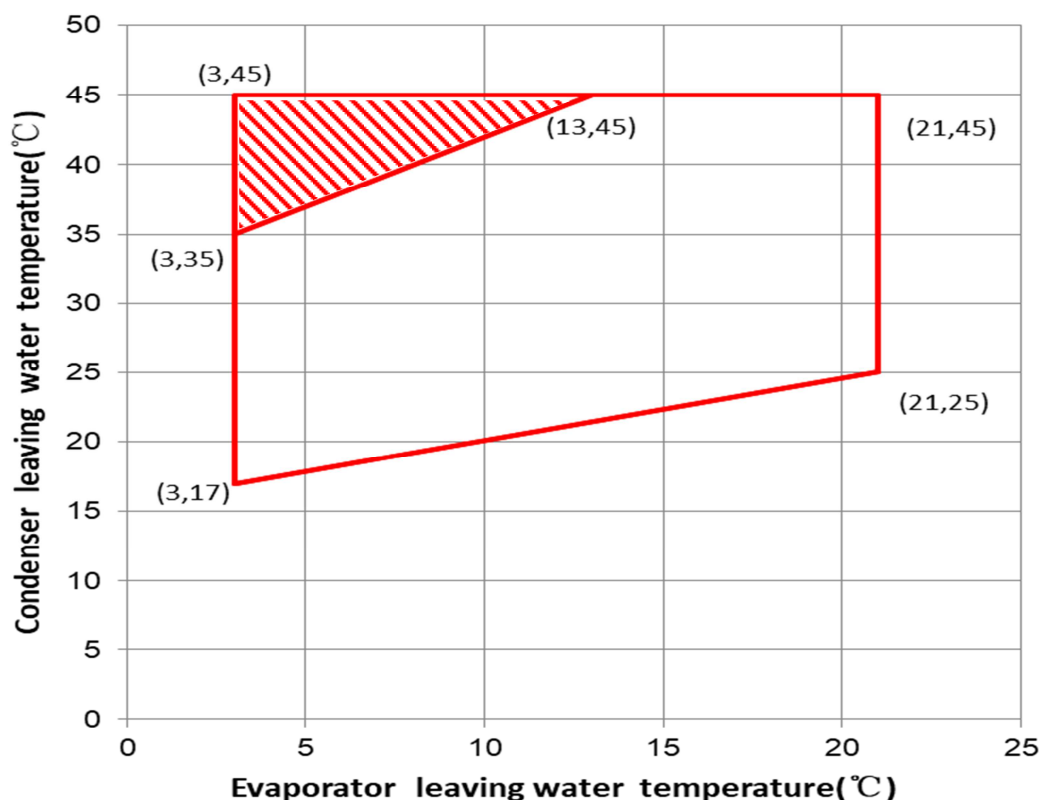
13. Application Range

13.1 Startup Range



Note: After the chiller is started, condenser inlet water temperature must be higher than evaporator inlet water temperature within 5 minutes .If not, please add a bypass valve in condenser inlet water pipe.

13.2 Operating Range



Note:

1. Different chiller will have small differences, please refer to rating.
2. The shaded part only for TGS490 (TGS490 has a wide operation range).

13.3 Water Flow Scope

For the cooling water: the turbulent condition cannot be reached in the slow flow velocity, and the heat exchange efficiency drops greatly;

In the fast flow velocity, the chiller water pressure drop enlarges, the waste work of the water pump raises and the lifetime of the heat exchange tube shortens.

$$V_{\min}=3 \text{ ft/s}=0.9 \text{ m/s}$$

$$V_{\max}=10 \text{ ft/s}=3.0 \text{ m/s}$$

For the chilled water: $V_{\min} = \frac{7500v}{D}$, wherein v - kinematic viscosity; D -pipeline diameter;

$$V_{\max}=12 \text{ ft/s}=3.6 \text{ m/s}$$

13.4 Minimum Water Content in Piping System

To obviate the frequent start and stop of chiller, and keep the running steady, the minimum water retaining capacity of the chilled water system shall be greater than the following calculation value.

The minimum water retaining capacity calculation formula $Q \text{ (m}^3\text{)} = (T \times 60) \times H / (\Delta t \times C_p \times \rho)$

Wherein: T : Compressor's minimum running time (min) is calculated by 5 min

H : Chiller's capacity control capacity (kW) = cooling capacity under full load (kW) $\times 0.3$

Δt : Constant temperature fluctuation = 3.4°C

C_p : Secondary refrigerant specific heat (kJ/kg $^\circ\text{C}$)

ρ : secondary refrigerant proportion (kg/m 3)

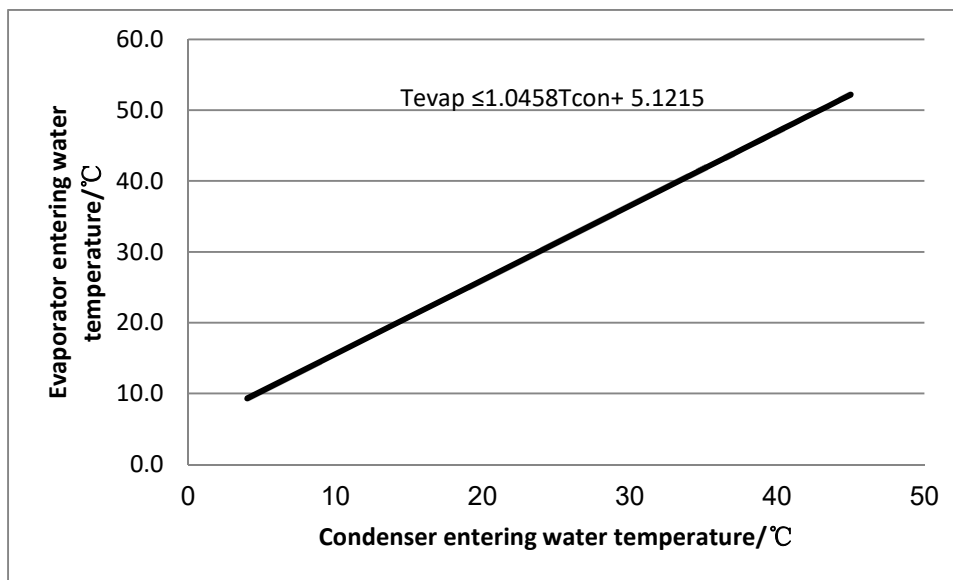
The cooling capacity under full load: calculated by the chiller's maximum cooling capacity as for the single compressor chiller; calculated by 50% of the maximum cooling capacity as for the double compressor chiller.

Note: The minimum water flow of the chiller water system should meet the requirements in Rating of national standard working condition and customer working condition.

13.5 Water temperature requirements at idle

While the compressor is at idle, if a Pressure Ratio > 1.2 is detected, then the check valve is likely not properly closed and the shaft may be rotating. This rotation while the shaft is not levitated can cause significant damage.

To avoid the situation, while the compressor is at idle, the following requirements must be met:



13.6 Application Standard

The standard running conditions of the water chiller are as follows:

Table 13-1

Supply Voltage	Rated voltage $\pm 10\%$
Phase Unbalance Rate	$\pm 2\%$
Frequency	Rated frequency $\pm 2\text{Hz}$
Operating Temperature	3-40°C
Relative Humidity	20 mm thick insulation will normally prevent condensation in environments with relative humidifies up to 70% and dry bulb temperatures ranging from 10 to 32°C. 40 mm thick is also available for relative humidifies up to 80% and dry bulb temperatures ranging from 10 to 32°C. If relative humidifies or dry bulb temperatures exceed the above scope, please contact factory to confirm the insulation thick.
Atmospheric Corrosive Gas Contents	Sulfur Dioxide: $\leq 10 \text{ mg/m}^3$
	Hydrogen Fluoride: $\leq 5 \text{ mg/m}^3$
	Hydrogen Sulfide: $\leq 5 \text{ mg/m}^3$
	Nitrogen Oxides: $\leq 5 \text{ mg/m}^3$
	Nitrogen: $\leq 1 \text{ mg/m}^3$
	Hydrogen Chloride: $\leq 5 \text{ mg/m}^3$
Installation	Indoor installation, no rain or direct sunlight (for installations of the outdoor, seaside, chemical plant, or places of high concentration of corrosive gas, please contact the local DAIKIN office and distributors)
Water Temperature	See 13.2

Range of Water Chiller	
Water Volume Range	See 13.3
Heat Exchange Tube Waterside Pressure	Standard chiller 1.0MPa (may be designed follow the customer's requirements)

13.7 Water Quality Management

As the chiller is operating, the water quality of the cooling and chilled water will directly affect the machine's performance and lifetime, which means it is necessary to survey the water quality beforehand, and conduct water quality control as the chiller runs.

The following table contains some parameters of the water quality of open system:

Table 13-2

Item		Chiller	Reference Value	Item	
				Corrosion	Scaling
Basic Item	pH (25°C)	-	6.5~8.0	O	O
	Specific (25°C)	μs/cm	<800	O	O
	Chloridion 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
	Full hardness	mg(CaCO_3)/L	<200		O
Reference Item	Iron 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: The "O" in the table indicates the relevant factors with corrosion or scaling inclination.

Table**Maintenance Schedule**

	Day	Week	Month	Quarter	Year	5 Years	Operation required
I Chiller							
Operation Record	O						
Analysis Operation Record		O					
Leakage Test		O					
Relieve valve or alternatives test						X	
II Compressor							
Compressor Vibration Test					X		
A. Motor							
● Ampere balance (within 10%)				O			
● Connecting Terminal (infrared thermometer)					X		
● Motor Cooling Filter Pressure Drop					X		
III. Running Control							
A. Operation Control							
● Calibration of Temperature Sensor					X		
● Calibration of Pressure Sensor					X		
● Setting and operation inspection of stop valves					X		
● Inspection of motor loading limit setting					X		
● Inspection of load control stability					X		
B. Protection Control							
● Testing Operation							
Alarm Delay				X			
Pump Interlock				X			
Protection List and Surge Protection				X			
IV. Condenser							
A. Approaching ΔT Evaluation (see note 1)			O				

	Day	Week	Month	Quarter	Year	5 Years	Operation required
B. Water Quality Test				V			
C. Clean Condenser Pipeline (see note 1)					X		X
D. Eddy current testing wall thickness						V	
E. Periodical protection							X
V. Evaporator							
A. Approaching ΔT Evaluation (see note 1)			O				
B. Water Quality Test					V		
C. Evaporator Pipeline Cleaning (see note 2)							X
D. Vortex Text Tube Thickness						V	X
E. Periodic Protection							X
VI. Economizer							
A. Check float valve		O					
B. Check solenoid valve						X	
VI. Expansion Valve							
A. Operation Evaluation (overheat control)				X			

Compressor Preventative Maintenance Tasks

	6 Mont hs	12 Mont hs	Other
I General Inspections			
Check physical condition of compressor.	X		
Check for excessive vibration from other rotating equipment.	X		
Check for oil in the system. The compressor must operate in an oil-free environment. Ensure all oil is removed from the system.		X	
II Compressor Inspections			
Connect to the compressor using the Service Monitoring Tools software and download fault and event logs. Review and save logs for future reference.	X		
Connect to the compressor using the Service Monitoring Tools software and perform a calibration. Do not save the calibration to EEPROM if the compressor has been operating correctly. Create and save a Calibration Report for future reference.		X	
III Electrical Inspections			

	6 Mont hs	12 Mont hs	Other
Check main power supply voltages.	X		
Ensure electrical terminals are tight.		X	
Check for signs of hot spots/discoloration on power cables.	X		
Check amperages during operation are as per design.	X		
Check DC bus voltage.		X	
Replace DC Capacitor Bus Bar Assembly.			Energized: 10 years Deenergized: 5 years
Check operation of all system safety devices and interlocks.		X	
Perform moisture-prevention measures.		X	
Replace Soft Start fan.			5 Years, Refer to Customer Notification B-CN-041- EN
IV Electronic Inspections			
Ensure all communication cables are secure.	X		
Ensure all electronic modules are secure.		X	
Check physical condition of all exposed PCBs.		X	
Check all exposed PCBs for dust build-up and clean if necessary.		X	
Check discharge and suction pressure/temperature sensors for accuracy against calibrated pressure/temperature gauges.		X	
V Refrigeration			
Check operation of IGV assembly.		X	
Check system refrigeration charge.	X		
Check superheat/level control, if applicable.		X	
Check system and motor-cooling liquid line to ensure sufficient sub-cooling.	X		
Verify discharge check valve operation. If there is backward gas flow immediately after stopping the compressor, replace the check valve.	X		
Check operating conditions external to the compressor.	X		
Inspect/clean motor-cooling strainer (if service has taken place).	As required		

O – Executed by the Customer: X – conducted by DAIKIN service personnel; V – executed by a third party's personnel.

Notes:

1. The approximate temperature of condenser/evaporator (Vessels of water temperature and saturated temperature difference between refrigerant) is a reaction to tube fouling. Especially when the condenser water flow fixed, fouling reflected in pipe is obvious. DAIKIN efficient heat exchanger has a fairly low close to the temperature difference, generally from 0.6°C-0.8°C.

The chiller can display the temperature and saturation temperature of the refrigerant. A simple subtraction can get approximate temperature. This method of reading is a recognized (including condenser water pressure drop is determined). If the approximate temperature increases 2°C even above it, means there is too much dirt in the pipe. The discharge pressure and the size of current also reflect the tube fouling conditions.

2. In the use of treated water or antifreeze liquid evaporator in closed loop is generally not affected by dirt, but must also be hard to detect the contents of the dirt on a regular basis.

3. After the expiration of the contract will no longer provide the original standard service.

Disassembly Disclaimer

- 1) the disassembly and repair of the unit shall be carried out by contacting the local sales organization of DAIKIN, and must be handled by professional personnel approved by DAIKIN;
- 2) any adverse consequences caused by disassembly and repair without authorization of DAIKIN shall be borne by the user, and DAIKIN will no longer provide corresponding quality assurance;

Service Procedure

The proper maintenance prolongs service life and enhances performance of the AC system.

The maintenance starts basically as the chiller starts. 3 to 4 weeks after the first start-up, it must be overall inspected, followed by periodical maintenance.

DAIKIN provides diversified maintenance service according to different customer needs.

Contact Methods

Company address: No. 33 Checheng Road, Economical and Technology Development District, Wuhan, Hubei, China
Post Code: 430056



★The printing may deviates from the real products, please refer to the real object when purchasing.

★All material is carefully reviewed. In case of any printing errors, DAIKIN bears no responsibility.

★Models, parameters and performance may change due to product improvement without further notification. Please refer to the nameplate for detail.