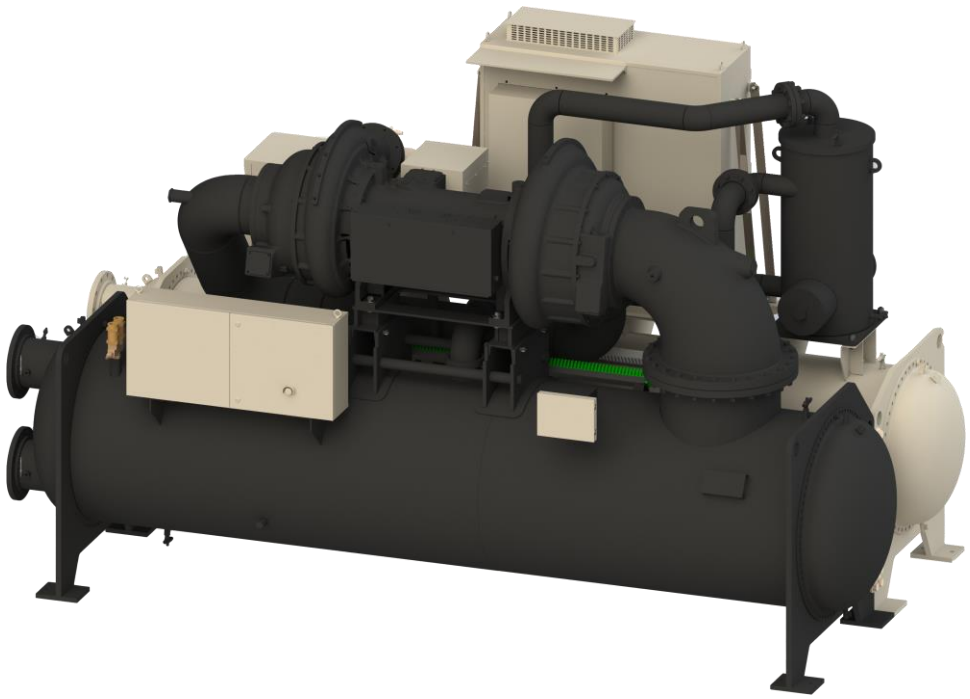
Installation and Maintenance Manual

IMM WMTC	
Group	Chiller
Date	2024.01
New Part No.	Z8100418-02
Old Part No.	Z8100418-01

WMTC

Magnetic Bearing Two-stage Centrifugal Chiller

With HFO Refrigerant R-1233zd(E)



Thanks for purchasing DAIKIN chiller.

This Manual specifies safety, installation and maintenance procedures.

Please read through the manual before installation and operation.

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

Engineered for Flexibility and performance

DAIKIN

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SAFETY CONSIDERATIONS

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 there from. 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 responsible for any direct or indirect personal injury and property damage caused by your failure that not following the warnings and precautions below. Users should read, understand and implement the warnings and cautions included but not limited to this manual.

Precautions in this section include:
Caution: a faulty operation that may cause injuries or equipment failure. It may lead to even more serious consequences according to severity.
Warning: a faulty operation that may cause death or serious injuries.
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.

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 done by qualified person.
Inappropriate installation might cause refrigerant leakage, electrical shock, fire accident etc.

C） Prevent refrigerant leakage.
In case of refrigerant leakage, repair the leakage as soon as possible 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 choose the cable according to local electrical standard or refer to "3.3.4 Wirings". Undersize cable might cause electrical shock or fire, etc.

F） Chiller foundation shall be capable to carry the 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 tight.
Ensure the connections of cables are firm. Otherwise it may cause fire accident.

I） If an individual power distribution line is used, to avoid injuries and death .Please follow:
1. Stick a label on the chiller: multiple power supply;

2. 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.

Caution:

A） It is forbidden to install the chiller in flammable gas leakage condition.
Fire accident or even explosion will happen when flammable gas concentration achieves certain level.

B） Chiller shell shall be grounded.
Ground cable shall avoid gas pipe, water pipe, lightning rod or telecom cable, wrong grounding might cause shock.

C） Ground protector shall be equipped for the chiller.
Leakage protector shall be installed as per local electrical standard. No leakage protector or improper installation may cause electrical shock.

D） Each chiller shall be equipped with dedicated circuit breaker.
If only one main breaker is equipped for multiple chiller plant, it may cause shock or fire accident.

E） Draining system shall be smooth at chiller installation location.
A wrong draining system may cause draining failure which in turn may harm chiller electric parts.

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

G） Chiller plant floor shall go through water proof treatment.
Water proof floor will protect chiller from moisture.

H） It is prohibited to locate chiller in severe environment.
Hot well, coast area, etc. will cause chiller corrosion which might cause shock or fire accident.

I） The water (condenser water, chilled water) in chiller system shall follow the criteria of local water quality standard.
Bad water quality will cause leakage and reduced chiller efficiency.

J） Follow the local regulations or rules while handling waste brine, cleaning agent, refrigerant, etc.
Illegally discharged waste liquid or gas will harm health and environment.

K） It is forbidden to close the AC contactor to start the compressor.
It may cause electric shock or fire accident.

L） It is forbidden to weld on the chiller.
Welding on chiller may cause refrigerant leakage. And too high concentration of refrigerant in air will cause suffocation.

M） It is forbidden to charge other kinds of refrigerant in chiller.
It may cause chiller instability, chiller efficiency decrease, or even fire accident.

N） Ensure sufficient space for chiller service and maintenance.
Insufficient space will threaten operator or service people's safety.

O） Highest possible to comply with all local and international regulations.

Precautions (Operation)

Warning:

A） If chiller running abnormally (smell of burning), please cut off the power and contact local DAIKIN office or distributors.
Running the chiller after abnormity happen might damage the chiller or shock and fire accidents.

B） It is prohibited to start or stop the chiller by main breaker or switch during normal working condition.
It may cause shock or fire accident.

C） It is prohibited to use other category coolant, otherwise it will cause fire accident or explosion.
D） Leakage of refrigerant.
If refrigerant leakage happens, certain measure shall be taken to prevent suffocation caused by high concentration of gas refrigerant in air.

Caution:

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） Do not operate the chiller with wet hands.
This is one of the causes of electrical shock.
C） It is prohibited to use oversized fuse.
An oversized fuse will cause protection failed. And it might damage the chiller or cause fire accident.
D） It is prohibited to local the chiller in flammable gas circumstance.
It might cause fire accident.
E） It is prohibited to bypass chiller protection device to start the chiller.
It may cause fire accident or explosion.
F） It is prohibited to start the chiller when open the starter cabinet door.
It may cause electrical shock or fire accident.
G） Ensure the power supply is correct.
Using the power supply other than the rated one specified on chiller name plant might cause electrical shock or fire accident.
H） It is prohibited to change the protection set point.
It may cause fire or explosion.
I） It is prohibited to put or hang any object upon the chiller.
Dropping of the object might damage the chiller.
J） It is prohibited to put any container which contains water on the chiller.
If water seeps in control cabinet, the insulation may become worse or even cause electrical shock.
K） Check the foundation after chiller operates for certain period.
Unfirm foundation may cause chiller distortion or even accident.
L） Stop the chiller and cut off the power supply when cleaning the chiller.
M） It is prohibited to flush the chiller.
N） It is prohibited to drink chilled water or cooling water.
O） Water quality must be ensured.
P） It is forbidden to charge other kinds of refrigerant in chiller.
Q） Don't touch the compressor and discharge pipes.
R） 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.
S） Treat the chilled water\cleaning agent\wasted refrigerant according to local rules.
Illegally dump the waste will break the law and harm environment.
T） Do not measure the resistance when the chiller is in a vacuum condition.
U） The evaporator entering water temperature shall not be more than 60°C, otherwise it may open the relief valve, leak refrigerant and damage control components.
V） Make sure the pressure is 0kpa before starting ANY WORK.
Do not remove the plug and flange of compressor or vessel or refrigerant pipes during operating. 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 less or equal to 0 kPa

before servicing.
Release pressure of evaporator and condenser by the stop valve on the vessel, and pressure of compressor by the pin valve on the pipes which connected to the compressor.
The pressure gauge shall be used for measurement to ensure that there is no residual pressure in the motor housing, gear housing and suction housing before operation.

Precautions (Remove and Repair)

Statement:

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.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.

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.

Caution:

A） Client shall follow the local regulations or rules when handling the wasted chilled water, cleaning agent and refrigerant.
B） Don't mix with other categories of refrigerant in chiller.
C） It is prohibited to change the set point of protection device.
D） It's prohibited to bypass the protection device when starting the chiller.
E） Ventilation is required during chiller servicing.
Refrigerant leakage will reduce the concentration of oxygen. So it may cause suffocation when ventilation is insufficient.
F） Disassembly Disclaimer.

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

All DAIKIN centrifugal chillers have been performed 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.

Warning:

Any damage caused by disassembly, installation and maintenance without the authorization of DAIKIN should be responsible for the user, DAIKIN not be responsible for any losses caused thereby.

Ⅰ General section

1. Introduction

1.1 General Description

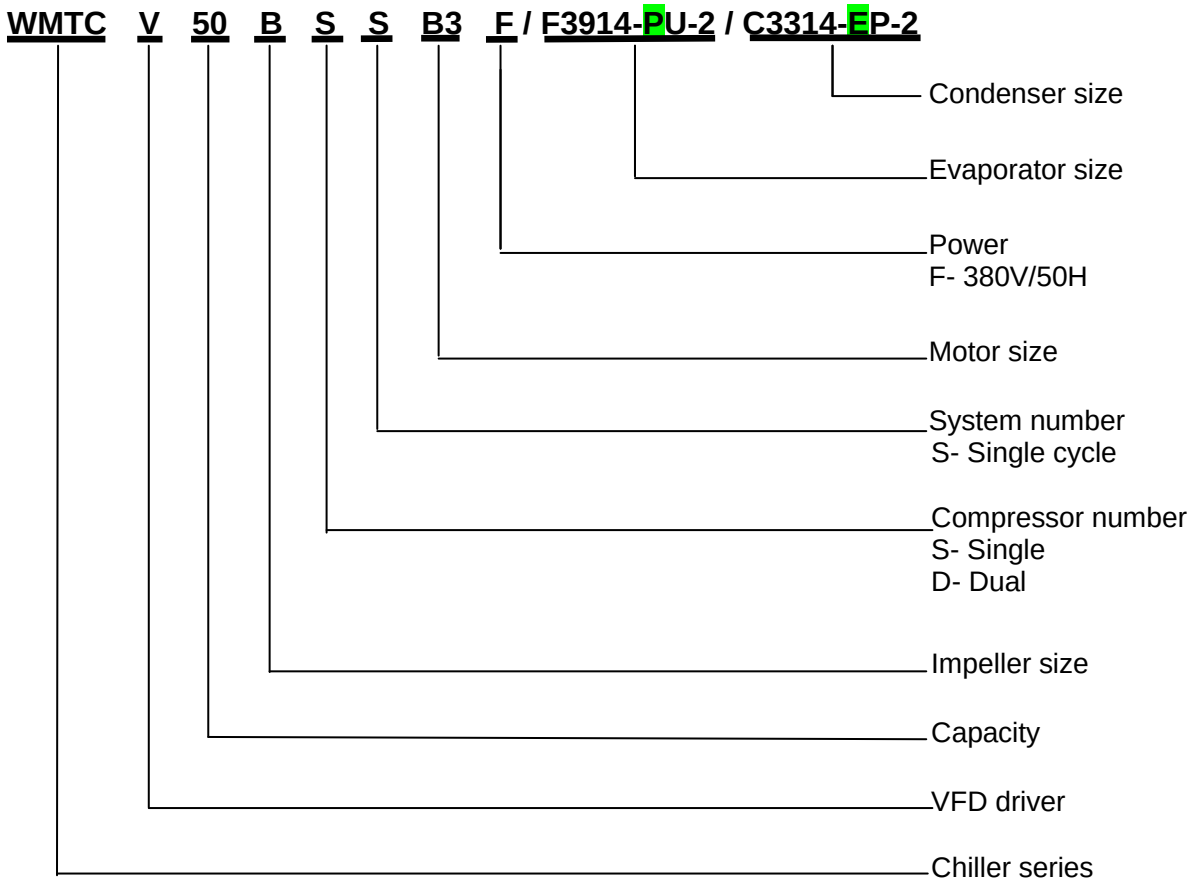
Based on matching with an optimized refrigerating system, DAIKIN WMTC centrifugal chiller utilizes an advanced automatic control system to accurately control each procedure in the operation process, so as to maintain the chiller always operate at the optimized state.

According to the different climate in different regions and also the customers' different requirements on the operation status of each chiller, DAIKIN offers different chillers with different specifications to satisfy customer's requirements.

DAIKIN water-cooled two-stage magnetic centrifugal chiller WMTC use the next generation environment-friendly HFO refrigerant R1233zd(E). This new refrigerant has extremely low ODP and GWP. As it is also a kind of negative pressure refrigerant, the evaporator pressure is lower than atmospheric pressure during operation. So chiller is equipped with purge unit to eliminate the non-condensable gases. It helps ensure the purity of the system to make sure the chiller always running stable.

1.2 Nomenclature

The information nameplate is located on the front door of the chiller control panel. The model on this nameplate shows the chiller configuration. See the below example to get the detailed description of the model:

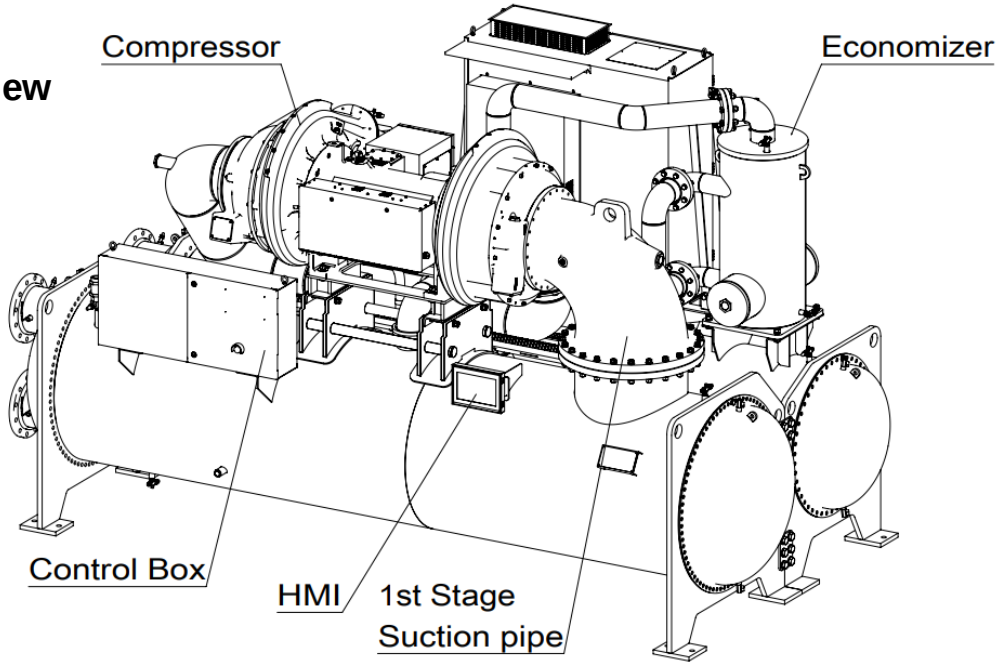


2. Major Components and Operating Principle

2.1 Chiller Components

The major components of WMTC chiller include compressor, evaporator, condenser, economizer, electric expansion valve (EXV), variable frequency drive (VFD), control panel and purge unit. The components and the locations are shown as below:

Front view



Back view

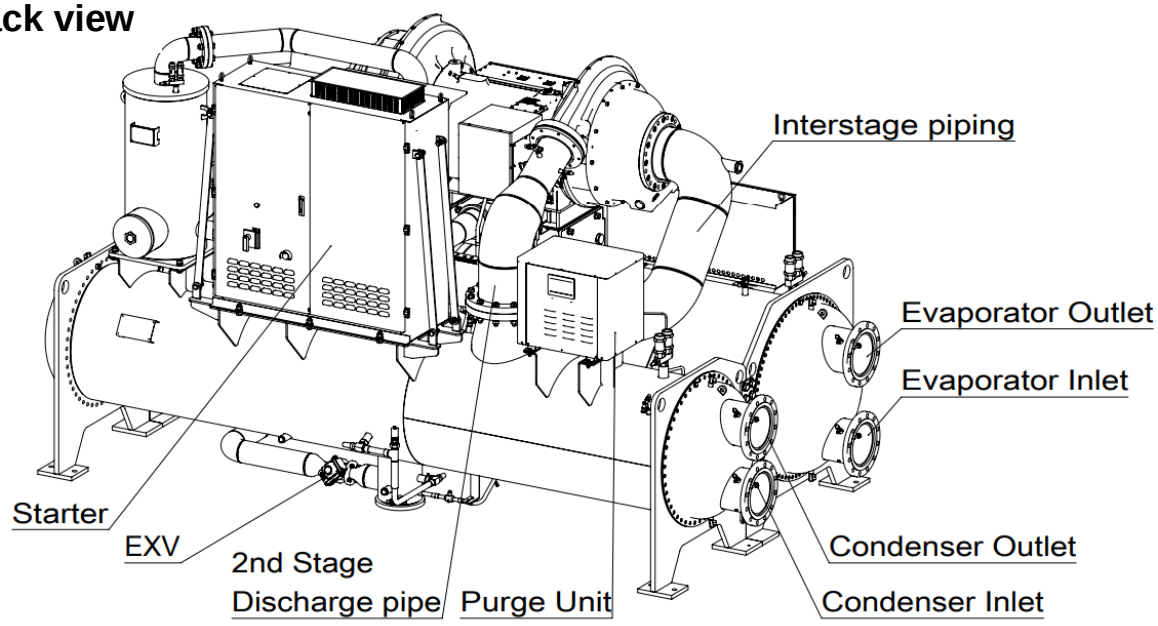


Fig. 2-1 WMTC components

Note: This picture is only for reference. Because of customized design or the improvements of the chiller, the productions may have differences without prior notice.

2.1.1 Compressor

WMTC chiller uses magnetic two-stage centrifugal compressor, the two impellers are arranged back to back and driven by motor directly to get best efficiency. The high-speed impellers transfer the energy from motor to the refrigerant, give the refrigerant a high velocity. Then the refrigerant goes through the diffuser to transfer the velocity energy to pressure energy. The overview of WMTC compressor is shown as below:

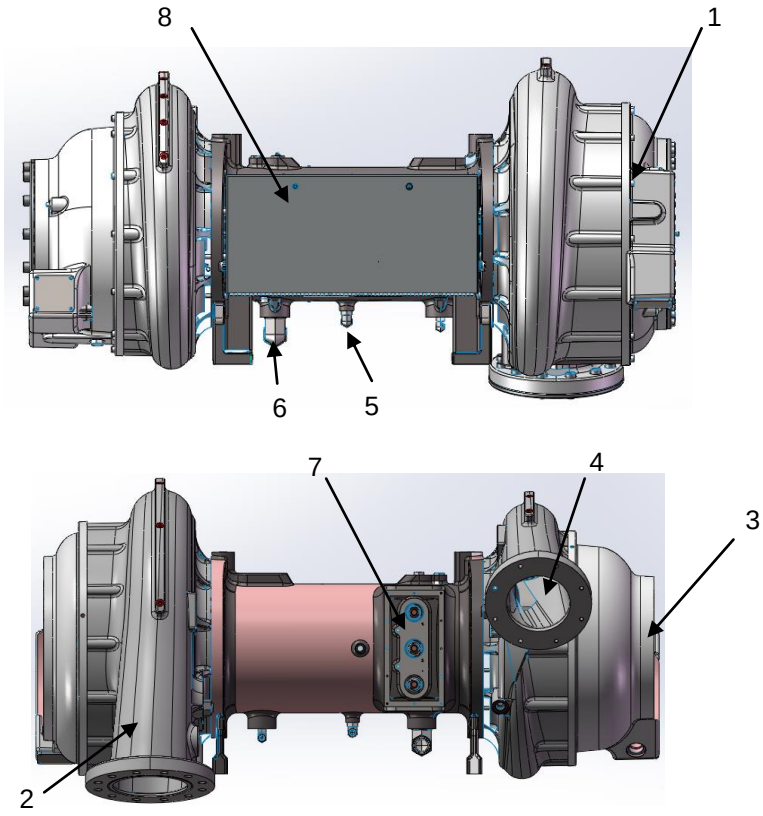


Fig. 2-2 WMTC compressors overview

The major components and connection ports are as below:

Table 2-1 Compressor major components and connection ports

No	Name	Description
1	First stage suction port	Compressor suction
2	First stage discharge port	First stage discharge
3	Second stage suction port	Second stage discharge
4	Second stage discharge port	Compressor discharge
5	Motor cooling inlet port	The inlet of motor cooling
6	Motor cooling drain port	The outlet of motor cooling
7	Motor terminal	Compressor power connection terminal
8	MBC box	Compressor magnetic bearing control system

The magnetic bearing control system (MBC) is located inside the MBC box. This box is installed on the compressor motor shell. The connection ports of the MBC box are as below:

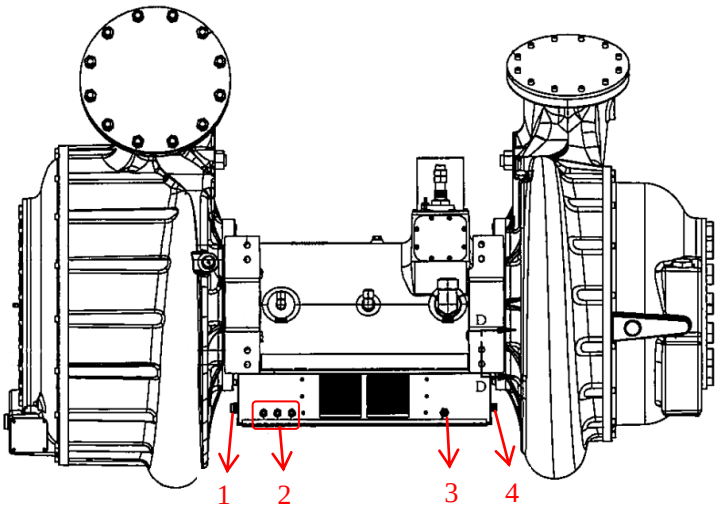


Fig. 2-3 MBC box overview

Table 2-2 Connection ports of MBC box

No	Name	Description or use
1	Nylon cable connector M25	M25
2	Nylon cable connector (3 places) M20	M20
3	MBC power connector 7/8-16UN	7/8-16UN
4	Nylon cable connector M20	M20

2.1.2 Evaporator

The evaporator of the WMTC chiller is a falling film type tube shell heat exchanger with the refrigerant loaded in the shell layer, and the water circulating in the heat exchange tubes. The evaporator is used to keep a low temperature to cool the chilled water.
The standard design pressure of the evaporator water side is 1.0MPa (G). The detailed information for different evaporator configuration is shown as Table 2-3.

2.1.3 Condenser

The condenser of the WMTC chiller is a hydraulic filling type tube shell heat exchanger. This vessel is used to coagulate the high temperature refrigerant from gaseous to liquid.
The standard design pressure of the condenser water side is 1.0MPa(G). The detailed information for different condenser configuration is shown as Table 2-4.

2.1.4 Economizer

WMTC chillers are equipped with flash tank economizer. This tank is special for two stage compressor to improve the efficiency. The liquid come from condenser go through the first stage expansion valve and flow into the economizer, in this tank, the refrigerant is separated to two parts: the flash gas flow into the compressor second stage and been compressed again, the liquid go through the float valve to get lower temperature and then flow into evaporator to cool the chilled water.

2.1.5 Expansion valve

WMTC chillers use motor-drive expansion valve. This valve is used to control the flow rate from condenser to economizer. The position of the expansion valve is adjustable automatically based on the evaporator pressure and condenser liquid level.

2.1.6 VFD

The compressor of WMTC chiller is driven by VFD. When the chiller is running, the VFD will

follow the demand to provide variable frequency to keep the compressor always operation at optimal state.

2.1.7 Control system

The control system of WMTC chiller includes a control panel and 12 inches HMI. The control panel is located on the evaporator and control the operation of the chiller by monitoring all operation conditions.

The HMI is the medium between chiller and users. Users can get all the operation information of the chiller by HMI, and use HMI to change the settings.

2.1.8 Purge unit

As R1233zd(E) is one of the negative pressure refrigerant, the inner pressure of evaporator will be lower than atmospheric pressure during operation, in this case the air or other non-condensable gas might mix into refrigerant and decrease the chiller efficiency. So purge unit ~~in~~is necessary for WMTC chillers. The purge unit is used for exhausting the non-condensable gases.

2.2 Working Principle

The working principle of WMTC chiller is showed as Fig. 2-4, includes refrigerant cycle, motor cooling cycle and purge cycle.

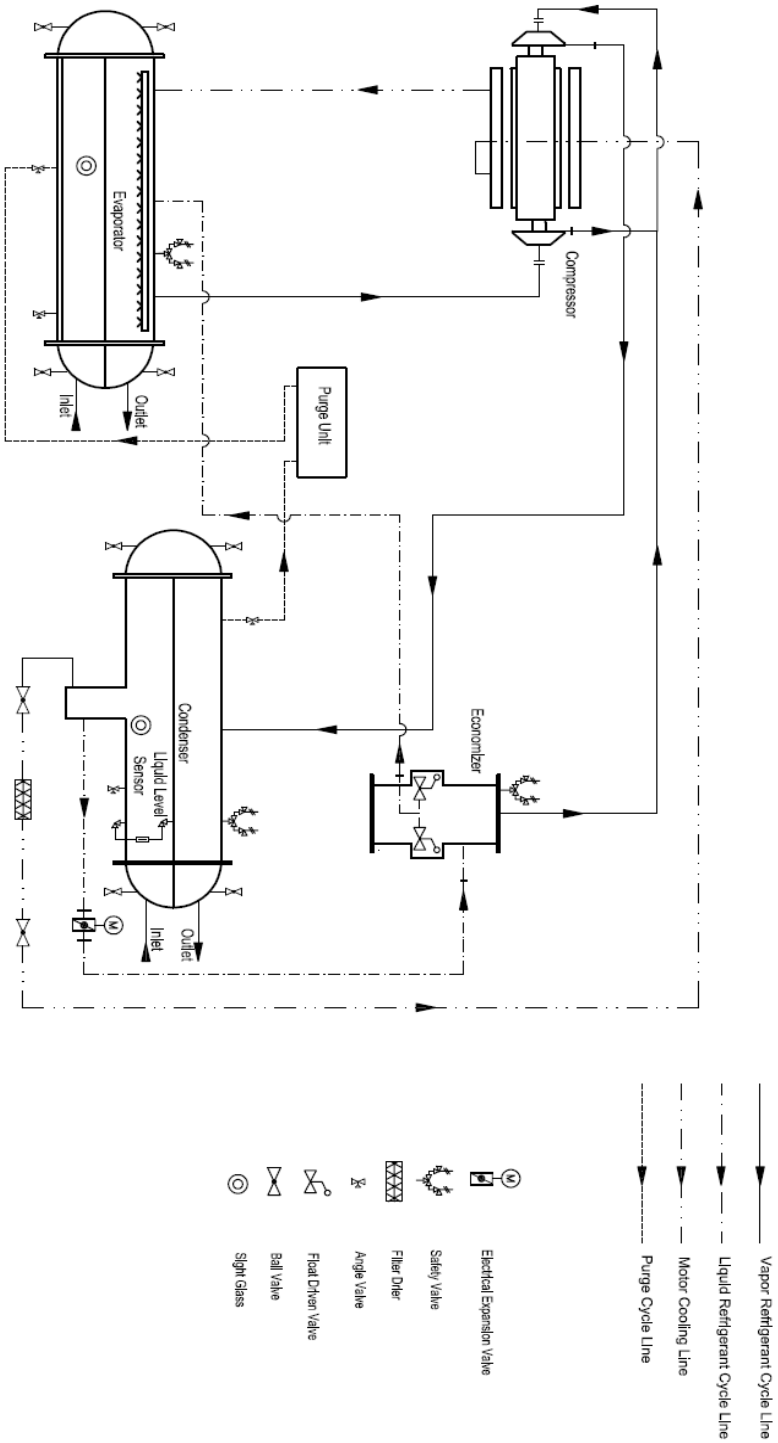


Fig. 2-4 WMTC chiller working principle

2.2.1 Refrigerant cycle

1. The compressor continuously sucks refrigerant vapor from the evaporator. As the compressor suction reduce the pressure of evaporator, the remaining refrigerant boils at a fairly low temperature. The heat required for boiling is obtained from the water flowing through the evaporator tubes.

2. After taking heat from the water, the refrigerant vapor is compressed by the first stage impeller. The compressed vapor is discharged through the inter-stage, flow to the second stage impeller and be compressed again. The compressed refrigerant then moves to condenser and gets heat transfer with cooling water through condenser tubes.
3. After condensation, the refrigerant becomes liquid and goes through the first stage expansion valve. The expanded refrigerant then flow into economizer, some liquid will flash into vapor and cool the remaining liquid. The separated vapor flows to the second stage of the compressor for higher efficiency. The remaining cooled liquid flows through the float valve, gets expansion again and becomes low temperature liquid. The low temperature liquid then flow into the evaporator and transfer the cooling capacity to the chilled water.
4. The low-temperature and low-pressure refrigerant vapor in evaporator enters the compressor and been compressed again, thus becomes the refrigeration cycle.

2.2.2 Motor cooling cycle

The motor is cooled by the sub-cooled refrigerant liquid. When chiller is running, the refrigerant is driven by the pressure difference between condenser and evaporator. The refrigerant flows from the bottom of the condenser and goes through the stop valve, filter, orifice then sprays to the motor. After cooling the motor, the refrigerant returns to the evaporator.

2.2.3 Purge cycle

The purge cycle is an independent cycle that completed by the purge unit. The main purpose of this cycle is separating the non-condensable gas that probably mixed in the R1233zd(E) low-pressure chiller. For more detailed of the ~~The~~ working principle, please refer to section 5.1. ~~is shown as Fig. 2-5~~.

~~The key components of purge unit include: purification tank, vacuum pump, stop valves and a small refrigeration system. The inlet of the purification tank is connected to the top of chiller condenser, it is used to suck the refrigerant which is mixed with non-condensable gases. The outlet of this tank is connected to the evaporator in order to drain the refrigerant liquid back to chiller. The vacuum pump is used to exhaust the non-condensable gases from the tank. The small refrigeration system of the purge unit provides continuous low temperature to coagulate the vapor refrigerant inside the tank.~~

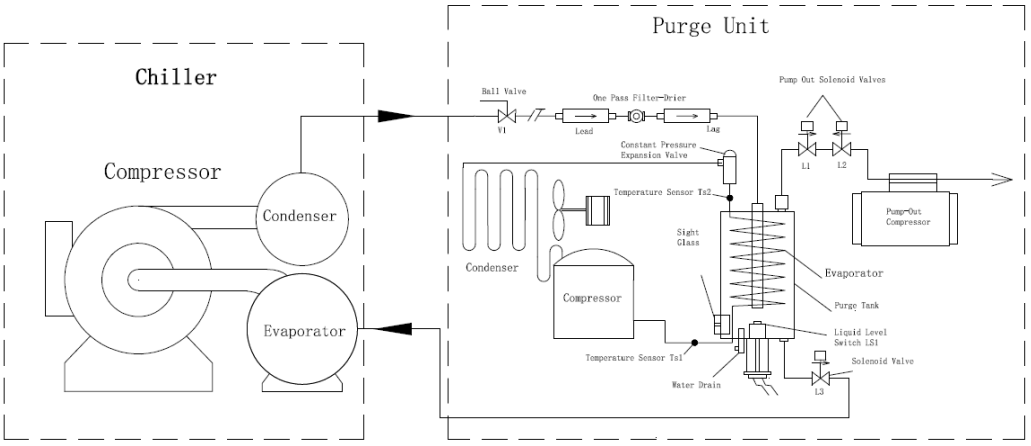


Fig. 2-5 Purge unit working principle

3. Installation

3.1 After Chiller Arrived At the Jobsite

Please confirm the below information when chiller arrived at the site:

1. Check the chiller package and the accessories to see if there is any damage. Any accessories lose or chiller damage is not included in the scope of Daikin responsibility.
2. Confirm the chiller model (noted on the chiller nameplate) and the quantity of accessories accord with the technical manual.

Caution:

All the valves have been confirmed before shipping. Only Daikin authorized service person can open or close the valves before first start up.

3.2 Lifting And Movement

3.2.1 Lifting

The lifting holes are signed by label at the four corners of the chiller. Please remove the insulation at the evaporator lifting holes when lifting the chiller. The base of the chiller should not dismantle before locating.

Take care of the pipes and control box when lifting.

In order to prevent damage, please follow the Fig. 3-1 to lift the chiller.

Caution

A） Please use the signed lift holes.

B） Keep the chiller always horizontal to prevent overturn.

C） Lift space should enough to lift the chiller.

D） use soft materials to protect the chiller.

Warning

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

B） Do not use the chiller base to lift the entire chiller.

C） The lifting rope must not touch the parts or pipes.

D） Each rope must be capable of supporting the entire weight of the chiller.

The weights of standard chillers are shown in the able 3-1.

Note：

1） Above information is only part of WMTC standard chillers, please take the weight on nameplate as final. Confirm the weight again before lifting.

2） Shipping weight include chiller components and refrigerant charge. Operation weight includes shipping weight and water weight.

Caution

The lifting weight should include the weight of chiller base, please confirm the actual total weight before lifting.

3.2.2 Movement

Take care when moving the chiller.

There are some copper pipes at the bottom of the chiller, please be careful when move the chiller across the steps.

3.2.3 CKD at jobsite

Caution

CKD at jobsite must be done by Daikin authorized person.

Warning

Make sure the inner pressure has fully released. Loosen the bolt with inner pressure may cause

personal injury.

For CKD option, the chiller will shipping to site as a package, the service person on site can choose which parts need to be disassembled. In this case, the chiller is charged with103kPa nitrogen and the refrigerant will be shipped independently by tank. In addition, Daikin will also provide O-rings for reassemble.

Typical CKD guide for WMTC chiller is shown in Fig.3-2.

Caution

The cable between compressor and starter should disassemble first.

Disassemble the components from top to bottom. Use lifting tools lift the component first and then loosen the bolts to prevent overturn.

Caution

Please contact DAIKIN to get the detailed information about the weight of the components and how to lift these parts.

Warning

Do not lift the parts without confirm the weight.

The chiller reassembly must comply with the technology rules. Check all the gaskets and O-rings, fasten all the bolts based on the required torque. After reassembly, check the leakage and vacuum. It is forbidden to charge the refrigerant before all the above tests being qualified.

Leakage test must follow the below steps:

1. Recycle all refrigerant to another tank.
2. Charge the nitrogen into the chiller through the stop valve on the top of condenser, the required pressure is 0.3MPa.
3. Check all the connection ports and seals and mark the leakage point.
4. After finding out all the leakage point, release the nitrogen and fix all the leakage point.
5. Repeat step 2 and 3, check the leakage again until all the leakage point has been fixed.
6. Charge the nitrogen into the chiller until the inner pressure increase to 0.3MPa, hold this pressure for at least half hour. No pressure decrease means the leakage test has been passed.

Caution

Do not use air or oxygen to increase the inner pressure to prevent burning.

Vacuum test must follow the below steps:

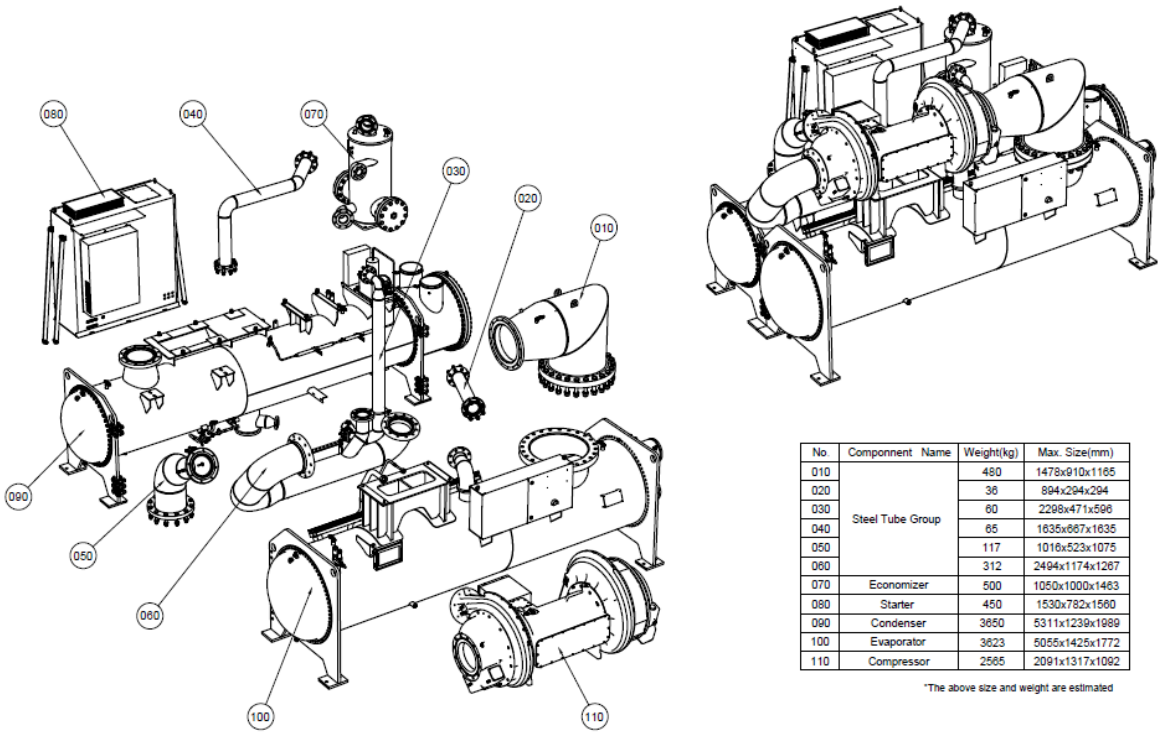
1. Vacuum test should be done after leakage test.
2. Install an absolute pressure manometer to the chiller.
3. Evacuate the vessel to at least 0.06kPa (abs), using a vacuum pump.
4. Shut off pump valve to hold the vacuum and record the manometer reading.
5. If the pressure rise is less than 56Pa within 8 hours, the chiller is sufficiently tight. Otherwise the chiller still has leakage point and need to repeat the leakage test.

Caution

Strictly follow the rules to finish the leakage test and vacuum, otherwise the chiller may have leakage risk.

Warning

Strictly follow the rules and the pressure requirements to finish the leakage test, higher pressure may cause personal injury.



No.	Componnent Name	Weight(kg)	Max. Size(mm)
010	Steel Tube Group	480	1478x910x1165
020		36	894x294x294
030		60	2298x471x596
040		65	1635x667x1635
050		117	1016x523x1075
060		312	2494x1174x1267
070	Economizer	500	1050x1000x1463
080	Starter	450	1530x782x1560
090	Condenser	3650	5311x1239x1989
100	Evaporator	3623	5055x1425x1772
110	Compressor	2565	2091x1317x1092

*The above size and weight are estimated

Fig. 3-2 Typical CKD guide for WMTC chiller

3.2.4 Charge refrigerant

Unless CKD or other special customized products, the refrigerant charge for WMTC chillers will be done before shipping. If customer need to charge the refrigerant on site, the chiller will shipping with less than 30kPaG nitrogen. Please make sure release the pressure before disassemble.

Check the leakage test and vacuum again before refrigerant charge.

The refrigerant weight is noted on the nameplate. The optimal charge may be slightly different from the nameplate shows. Please contact the Local branch if necessary. Strictly follow the below requirements during refrigerant charge.

1. Always keep the pumps on for chilled and condenser water. Make sure all the air has been totally exhausted from water pipes.
2. The pressure of saturated R1233zd (E) is lower than atmospheric pressure if the temperature is lower than 18°C. If the temperature on site is nearby 18°C, use electrical heating to increase the pressure of the refrigerant tank. Install a pressure gage to the tank and heat the tank slowly to make sure the pressure of the tank is 30kPa higher than atmospheric pressure.
3. Use a flexible pipe to connect the tank and chiller refrigerant charge port. Keep the chiller refrigerant charge port close and use the refrigerant to exhaust the air inside the pipe.
4. Open the chiller refrigerant charge port and charge the refrigerant.
5. At the beginning, the refrigerant will automatic flow into the chiller because of the pressure difference between tank and chiller. But as the pressure inside the chiller is increasing, the charging will become more and more difficult. In this case, it's better to heat the refrigerant tank to faster the speed.
6. Close the chiller refrigerant charge port and the valve on the tank when refrigerant charge is finished. Then move the flexible pipe away.

Caution

Always keep the pumps on during the refrigerant charge, otherwise the tubes may freeze!

Warning

Make sure the inner pressure of the tank always lower than 0.25MPaA when heating.

It is forbidden to use fire to heat the tank directly!

Do not touch the refrigerant directly if there is any leakage. Close the valve first and wear protection suit.

3.3 Installation

3.3.1 Safety considerations

Please comply with the following safety considerations when install the WMTC chiller:

Caution

A） Chiller shall not be located at the flammable gas space to prevent fire accident.

B） 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.

C） Chiller shall be located at the place which is not sensitive to vibration or noise. Otherwise isolator should be used to decrease the noise and vibration.

D） Exhausting fans is necessary for chiller plant to prevent suffocation caused by refrigerant leakage.

E） Chiller shall be located at the place with expedite drain. The ground should be waterproof. Otherwise chiller will be damped.

F） Please reserve enough maintenance clearances.

G） Install lighting equipment if daylighting is not enough.

H） Remove the spacer before install the chiller.

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

J） 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.

K） Chiller shell shall be grounded. Ground cable shall avoid gas pipe\ water pipe\lightning rod or telecom cable, wrong grounding might cause shock

L） Highest possible to comply with all local and international regulations.

Warning

A） Chiller installation must be carried out by qualified person. Inappropriate installation might cause refrigerant leakage, electrical shock, fire accident etc.

B） Strictly follow this manual during installation. Inappropriate installation might cause refrigerant leakage, electrical shock, fire accident etc.

C） 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.

D） Standard chiller is not designed for explosion condition. It is forbidden to install the chiller in flammable gas space.

E） Temperature of chiller plant shall be within 3C~40°C. Relative humidity shall be less than 90%. Temperature fluctuation shall be within 8°C per hour. If chiller is installed in cold area, freeze-proofing shall be taken not only for chiller but also for other device in chilled water and cooling water system.

F） 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） Remove the sensors before welding the pipe.

3.3.2 Foundation

Please locate the chiller where the chiller's weight is bearable. The foundation should be horizontal and smooth. The height difference of the foundation along the chiller length should less than 6.5mm, the difference along the chiller width should less than 2mm/1000mm.

Use the following way to make sure chiller is horizontal:

Install an air level on the top of condenser shell along the length, check the levelness of the length. The deflection angle should within -0.1°~0.1°. Then use the same way to check the levelness along the width, the deflection angle should within -0.2°~0.2°. If the levelness is not acceptable, lift the chiller and put some pad on the lower side to adjust the levelness.

As the vibration is extremely low during operation, rubber pad is enough for WMTC chillers. Each WMTC chiller is shipping with 4 rubber pad.

The foundation drawing for WMTC chillers is shown as Fig.3-3. Foundation drawing parameters is shown as Table 3-2.

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

The chiller is supported by the four feet; the weights of these four feet are shown as Fig. 3-4.

If customer needs to purchase the spring isolator by themselves, the recommended load shows Table 3-3.

Note:

1) As vibration is extremely low, WMTC chiller can be installed on the concrete floor directly.
2) If chiller foundation is needed, please refer to above drawings.
3) If the chiller plant room isn't located on the ground floor, the floor should be rigid enough to bear the operating weight.
4) The recommended size of anchor bolts is M27. Anchor bolts are not in our standard scope of supply.
5) If required, Daikin can provide spring isolator as option.

Spring isolator installation:

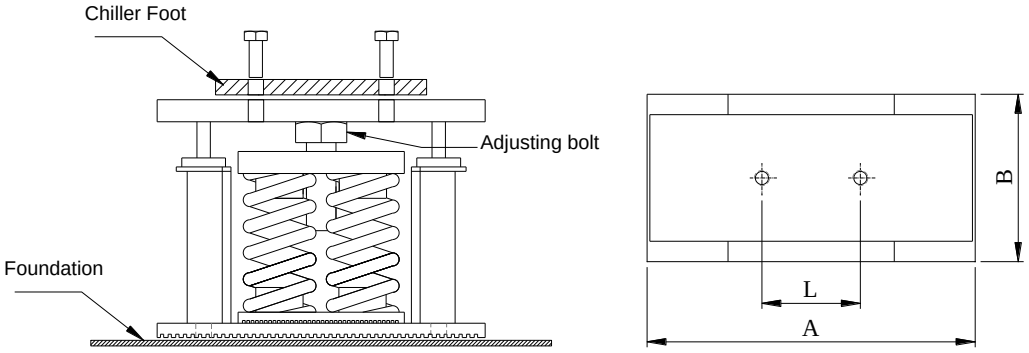


Fig. 3-5 Installation guide of the spring isolator

Fig. 3-5 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 3-6, the two holes in each corner match the two bolts on spring isolator.

Make sure there is enough space around the chiller for maintenance.

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 tubes.

The required maintenance clearances are shown as Table 3-4.

In addition, sound insulation should be considered during installation. Please use appropriate isolator to reduce the sound level if noise is not acceptable.

3.3.3 Piping

1. Water pipes

The responsibility of piping belongs to the water system design group. Fig. 3-7 shows the piping and instruments diagram drawing for typical water system.

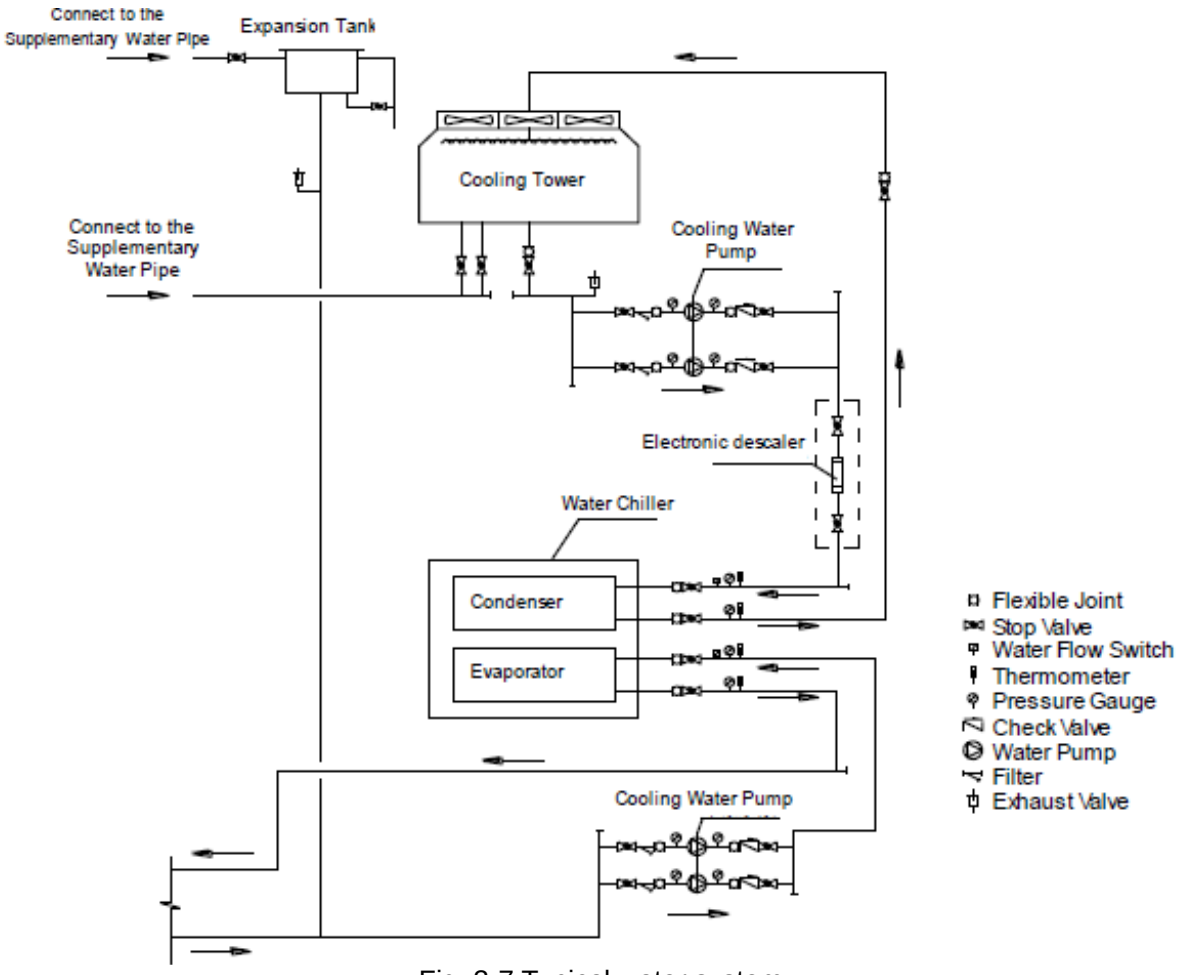


Fig. 3-7 Typical water system

The below items are the suggestions for piping. Daikin suggest to follow these requirements to make the whole water system more reliable.

A) Countermeasures for vibration

● To decrease the spread of vibration which would affect other equipment, it is necessary to use flexible joints between the chiller and pipes.

● Please install pipelines support.

● Make sure there is no additional force from pipes to chiller.

B) To prevent water flow shortage

● Please use rational pipe diameter, suggest to use pipes which have bigger diameter than chiller inlet and outlet pipe.

● Flow valves should be installed on the middle of chiller inlet pipe and located at the horizontal pipe.

Before the valve, the straight pipe should have length at least 5 times than pipe diameter.
● In order to confirm the flow rate, suggest to install pressure gage on the inlet and outlet pipe.
● For standard chiller, water flow switch has been installed before shipping. If customer choose target flow switch, the switch need to be installed at jobsite. Please follow the specification to install the target flow switch.
● If customer purchase flow switch by themselves, the flow switch should follow the following requirements:
1) Please choose the right flow switch based on water flow rate, pipe diameter, the accuracy and the control target.
2) The flow switch should be reliable and convenient to install.
● If the pumps and cooling tower fans are controlled by the chiller, please strictly follow the electrical wiring requirements.

Caution

The flow switch must be installed and the signal must correctly send to chiller controller, otherwise DAIKIN won't be responsible for any damage caused by this.

C) Eliminate the impurities in water loop
● It is necessary to install strainers and drain ports on the pipes, otherwise the tubes may get damage.
● Install the strainers nearby the inlet of the pipes. The mesh number of the filter should not less than 40.
● Please reserve enough maintenance space for exchange the filter element.
● Please reserve enough maintenance space to open or close the drain port.
● Install valves on both inlet and outlet pipes to make tube cleaning more convenient.
● In order to disassemble the water head more convenient, please use flexible joint with two flanges on both side to connect the chiller and water pipes.
● Use pipes to connect the chiller drain valve to drainage ditch. The chiller drain valve is installed on the bottom of water head.
D) Prevent air mix into water loop
● Please install release valve on the top of the water loop to exhaust the air. Water with air mixed in will reduce chiller efficiency and shorten service life of tubes.
● Please pay attention to the flow rate. Cavitation may occur if the flowrate is too high.
E) Follow the chiller operation guide
● Please ensure chiller operates within the maximum working pressure.
● Please ensure the volume of water loop is higher than minimum to prevent chiller on/off too often.
F) Anti-corruption treatment for pipes and tubes
● It is forbidden to install grounding cable on water pipe to prevent electrical erosion.
● Anti-corruption treatment shall be taken for buried pipes.
● For chilled water storage application, if the chilled water storage tank is not totally sealed, please clean the bottom of the tank and exchange the water every year.
It is necessary to measure the pH range for new chilled water storage tank. If pH is out of range, the corrosion rate of the tubes will increase. So it is necessary to exchange the water until the water quality satisfied the requirements.
In addition, the chilled water storage tank may get leakage during long-term operation. If the water inside the tank is mixed with seawater or other polluted water, the tank and tubes will get fouling. So it is important to check and exchange the water in time.
● Please pay attention to the water quality, especially for the condenser water, otherwise the chiller efficiency will decrease and the tubes will get damaged.
● If secondary refrigerant is not pure water, please make sure all the components which will get touch with secondary refrigerant are corrosion- resistant.
G) Freeze proof
● 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 can be below 0°C, the condenser water and cooling water pipes need

to be freeze-proofed. One of the treatments is heating the water pipes.

● If the ambient temperature can be below 0°C and the chiller is not running, it is necessary to exhaust the water from chiller and pipes. Otherwise DAIKIN will not responsible for any damage caused by freeze.

2. Relief valve pipes

Caution

The evaporator/condenser and economizer of WMTC chiller are pressure vessel. The registration and periodic inspection of pressure vessels shall satisfy the local regulation.

As safeguard, relief valves are installed on all pressure vessels. The relief valve will open once the inner pressure of the vessel is too high to protect the body of the vessel.

Each vessel of WMTC chiller has two or more relief valves, the following picture shows the installation. The three-way stop valve under the relief valve is used for the calibration of relief valves. As shown on the following picture, No. 1 relief valve is activated when the three-way stop valve is turning to the right side. Otherwise No. 2 relief valve is activated.

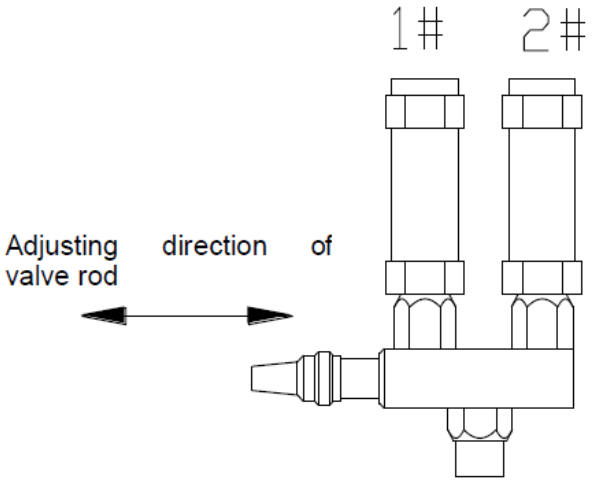
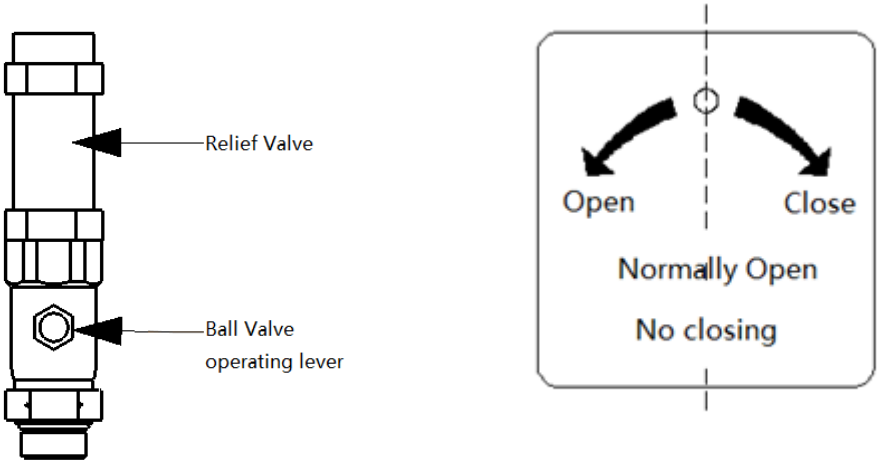


Fig. 3-8 Installation of relief valves

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.



In order to exhaust the refrigerant to outdoor, it is necessary to install a pipe for each relief valve. Please use flexible joint for connecting. The following picture shows the typical relief valve pipe.

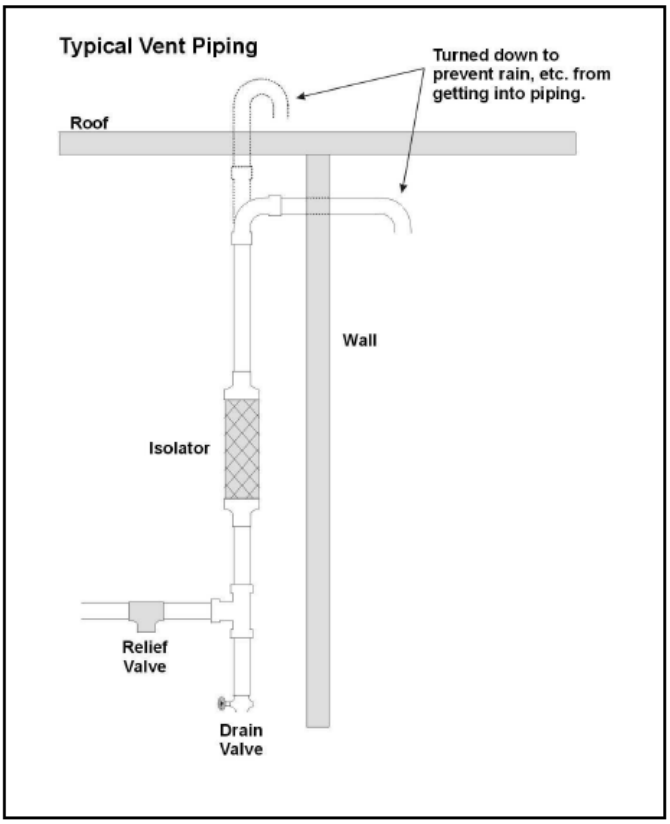


Fig. 3-9 Pipes for relief valve

Caution

Move the plastic plug inside the relief valve away before connecting. Make sure the piping satisfy the local regulation.

The type and size of the relief valve connecting port are shown as below:

Table 3-5 Relief valve parameters

Vessel	Location	Type and size		Setting Pressure（MPaG）	Default flow rate（air, kg/min）	
		WMT500	WMT800		WMT500	WMT800
Evaporator	Top of the shell	FNPT 1-1/4	FNPT 1-1/2	0.47	28.98	37.14
Condenser	Top of the shell	FNPT 1-1/4	FNPT 1-1/4	0.47	28.98	37.14
Economizer	Top of the shell	1-14 FUNS	1-14 FUNS	0.47	4.98	4.98

Caution

When chiller is doing leakage test or charging refrigerant, make sure the pressure of the tanks or pipes which connected to chiller is lower than the relief valve setting pressure.

As the two relief valves installed on one three-way stop valve are mutual standby, the pipes for this two relief valves can join together to one exhausting port.

If the relief pipe is too long, the diameter of the pipe should increase because of the pressure loss. The following form shows the pipe diameter and maximum length.

Table 3-6 Maximum length for different relief pipe diameter

Pipe diameter（mm）	32	40	50	65

Maximum length（m）	≤0.61	≤6.1	≤30.5	≤76.2

If two or more relief valves join into one pipe, the sectional area of the pipe must not lower than the sum of each relief valve area. The diameter can be calculated by following formula:

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

D1, D2 and Dn are the diameters of the branch pipes.

3.3.4 Wirings

Wirings on site should be done by certified specialized person. Follow the local electrical standard and the electric diagram for WMTC chiller.

1. Power cable

Follow the Table 3-7 to choose the size of power cable

Note:

1) Cable type must satisfy the power voltage and the size should follow the above requirements. As the voltage will decrease along the cable, the maximum length of the power cable should also satisfy the voltage range: -10%~10%. The length in above form is just for reference; customer should also comply with the local regulation.

2) Suggest to use YC/VVR/YJVR cable type for 380~460V voltage. If the cable size is not enough, use two or more cable for single phase to make sure the total area is enough. The cable should supported by bracket without any conduit. If conduit has to be used, please increase the cable size.

Do not put cable of single phase in metal conduit. If needed, put all cables for 3-phases in one big conduit. All the cables cannot have any splice.

Take the following picture for reference:

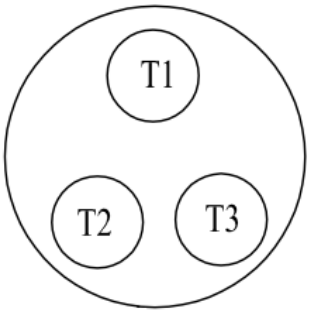


Fig. 3-10 Three cables in one drive pipe

Note: PE cable can put into any conduit. T1/T2/T3 are the incoming power cable for the starter.

The starter of WMTC chiller is unit mounted, the wiring from starter to compressor and control panel has been done before shipping. The only thing need to do is connect the power supply to the incoming terminal of the starter. See below picture for reference:

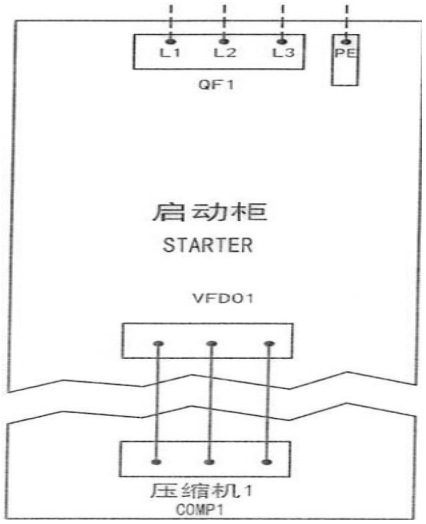


Fig. 3-11 Field wirings of the starter

Please pay attention at the following items:

A） Do not start the chiller before all wirings are completed.

B） The bolt should be fastened when connecting the wirings, the tightening torque should not less than the Table 3-8 requirements.

C） To prevent electric shock, please make sure the earth terminals inside the starter and control panel have connected to earth conductor.

The earth terminal inside the control panel is shown as below:

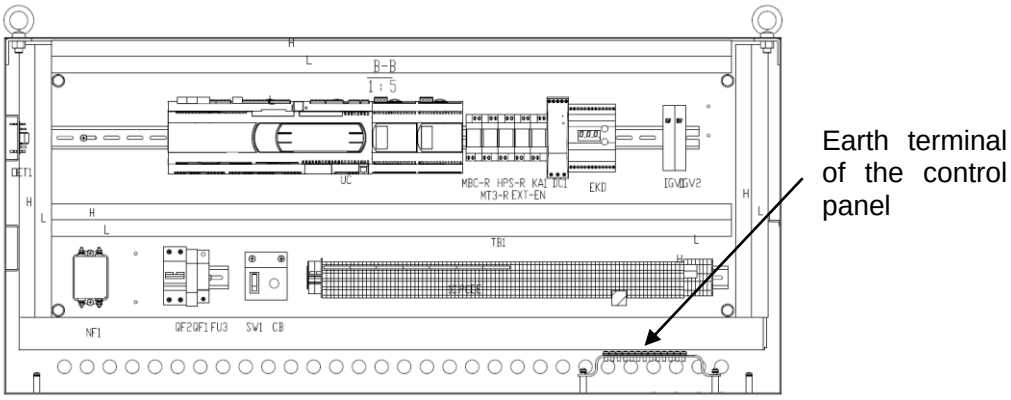


Fig. 3-12 The location of the earth terminal in control panel

The earth terminal inside the starter is shown as below:

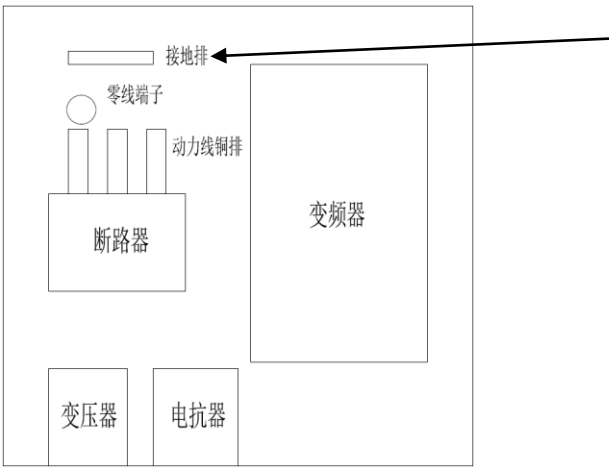


Fig. 3-13 The location of the earth terminal in starter

The compressor has two M10 screw bolts used as earth terminal which is show in Fig 3-14:

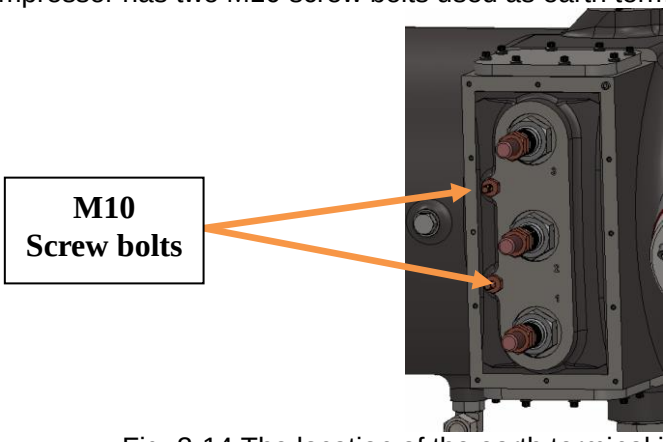


Fig. 3-14 The location of the earth terminal in compressor

The earth terminal of Chiller unit is located in the foundation, it is the M20 screwed hole which is show in Fig 3-15:

Fig. 3-15 The location of the earth terminal in chiller unit

The earth resistance should lower than 0.1Ω.
Earth cables shall not connect to natural gas pipes, water pipes, lightening rod and telephone cables.
Natural gas pipes – leakage of the natural gas may cause explosions or fires;

Water pipes – if the material of water pipe is not metal, the earth cable will be useless.
Lightening rod and telephone cables – will cause earth voltage suddenly increase at thunderstorm weather.
Please take GB 50169 as reference for starter earth wiring.
The size of control panel earth wiring is 10mm2.

D） Clean the starter box and the electrical components before wiring. Prevent the metal scraps drop into the box when drilling holes on the box. Otherwise the metal scraps may cause short circuit.

E） Please pay attention to protect the terminals and copper bars.

F） Make sure all the tools and metal scraps have been cleaned after finished wiring.

G） The input voltage should within ±10% of nameplate voltage, and the unbalance should lower than 2%. As 2% voltage unbalance will lead to 6~10 times current unbalance, it is important to keep the voltage unbalance at low level.

2. Control panel

The wiring of control panel including the wirings connected to compressor and starter has been done before shipping. Please check the wirings according to the electric diagram before power on.

Some of the system components such as water pump may need to connect to chiller control panel, these wirings should be field wired. Please take the following diagram as reference:

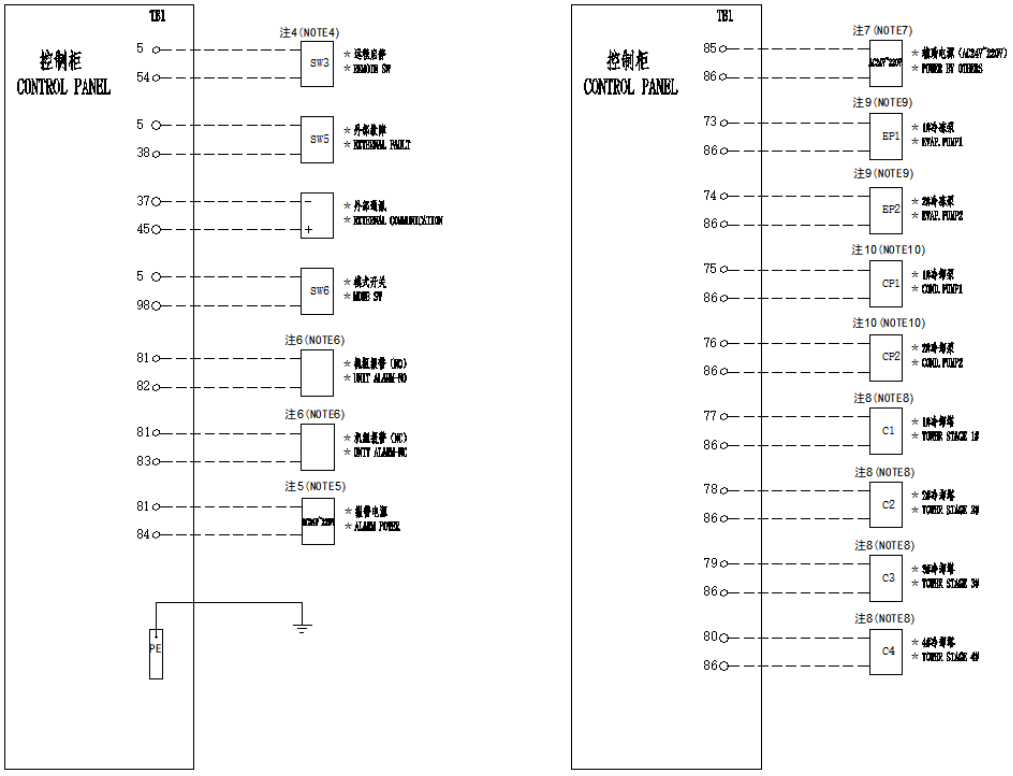


Fig. 3-16 Field wirings of control panel

Notes for field wiring:

1. For the low voltage wirings, please use 2.5 mm^2 copper cores for length lower than 15m and 4 mm^2 for length above 15m. 24VAC wirings should separate from 110VAC and 220VAC.
2. Voltage unbalance should lower than 2%. As 2% voltage unbalance will lead to 6~10 times current unbalance
3. Terminal 5 and 54 is used for remote control. Install a switch between these two terminals to start the chiller.
4. Terminal 85 and 86 should be connected to a stable power; this power is used for the coils of all

the relays. The voltage of this power should be within 24~220V.

5. The voltage of unit alarm relay coil should be the same as above and the maximum power of this relay is 25VA.
6. The voltage of cooling tower relay coil (C1-C4), chilled water pump relay coil (EP1, EP2), condenser water pump relay coil (CP1, CP2) should be the same as above. All the maximum power of these relays is 25VA.
7. Follow the above drawing to connect the cooling tower relay (C1-C4), this relay is used to start up the cooling tower fans.
8. Follow the above drawings to connect the chilled water pump relay (EP1, EP2), this relay is used to start up the chilled water pump.
9. Follow the above drawings to connect the condenser water pump relay (CP1, CP2), this relay is used to start up the condenser water pump.

3.Unit grounding instructions

（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：

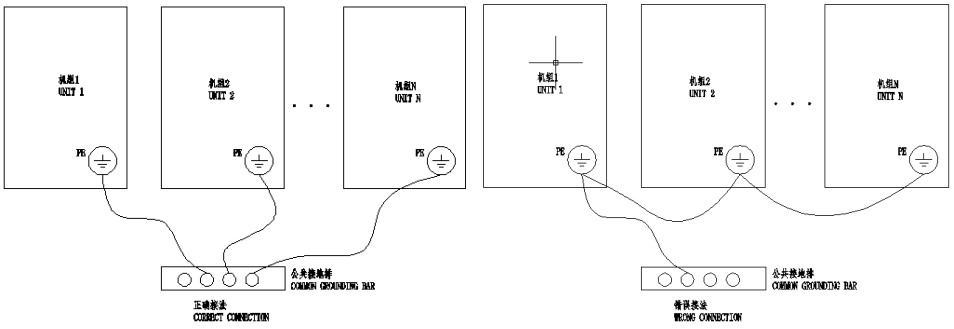
Cross-sectional area of phase line S（mm^2）	Grounding wire cross-sectional area （mm^2）
S≤16	S
16<S≤35	16
S>35	S/2

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.

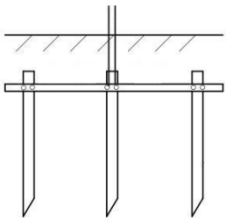
（3）Grounding requirements for single or multiple units：

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：

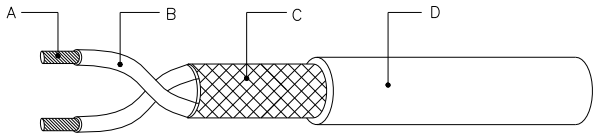
Grounding issue at user side would be involved in IT, TT, TN-C, TN-¬CS system,except the TN-S system. It is recommended to use an independent grounding electrode (as shown in the schematic diagram), and ensure that grounding resistance is less than 4Ω at where the unit is connected to the grounding bar. In addition, it is not allowed to use metal pipes on site (such as water pipes, gas pipes, etc.) as grounding electrodes. .



Schematic diagram of grounding electrode

4.Description of communication between units

1、 1. Specification requirements for communication lines：



屏蔽双绞线图例

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

B：Insulation

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

D：Outer sheath (PVC)

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

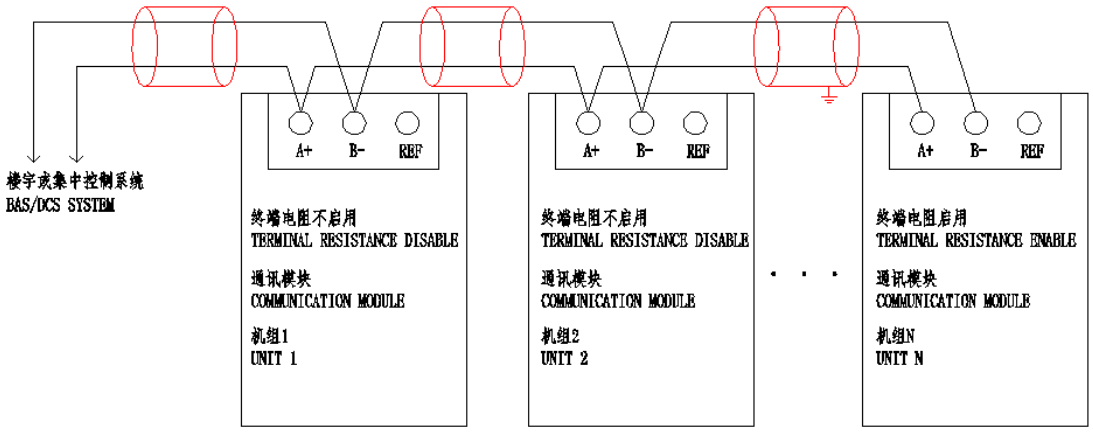
2）Refer to the use of UL2547 or UL2791 wire, or use RVVP 2x0.5 or RVVP 2x0.75 GB standard shielded twisted pair.

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 only one end of the shielding layer and 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 disabled. (The terminal resistance is recommended to be 120Ω).

3）The communication lines should be laid far away from wires with strong electricity, and the spacing should meet the specification requirements.



3.3.5 Insulation

The insulation is one of the standard configurations for WMTC chillers. DAIKIN use at least 20mm thickness insulation cover all the cold surface to prevent condensation.

If customer chooses DAIKIN insulation on site, DAIKIN service person will finish the insulation on site according to standard insulation guide.

If customer chooses insulation by themselves, the insulation should at least includes the below items:

1. Evaporator shell, tube sheet, water head, inlet and outlet pipes.
2. Suction pipe and inter stage pipe.
3. Compressor first stage suction and discharge components, second stage suction components, motor shell (including terminal foundation) and compressor feet.
4. Pipe from expansion valve to economizer.
5. Economizer and pipe from economizer to inter stage, pipe from economizer to evaporator.
6. Drain pipes for motor cooling and purge unit.

The insulation for other components can be decided by customer, but it is important to reserve space for maintenance.

The typical insulation diagram of WMTC chiller is shown in Fig.3-17.

As the Fig.3-18 shows, please keep condenser and its auxiliary pipes thermal insulation if condensation is likely to occur in the actual temperature and humidity environment of the equipped room.

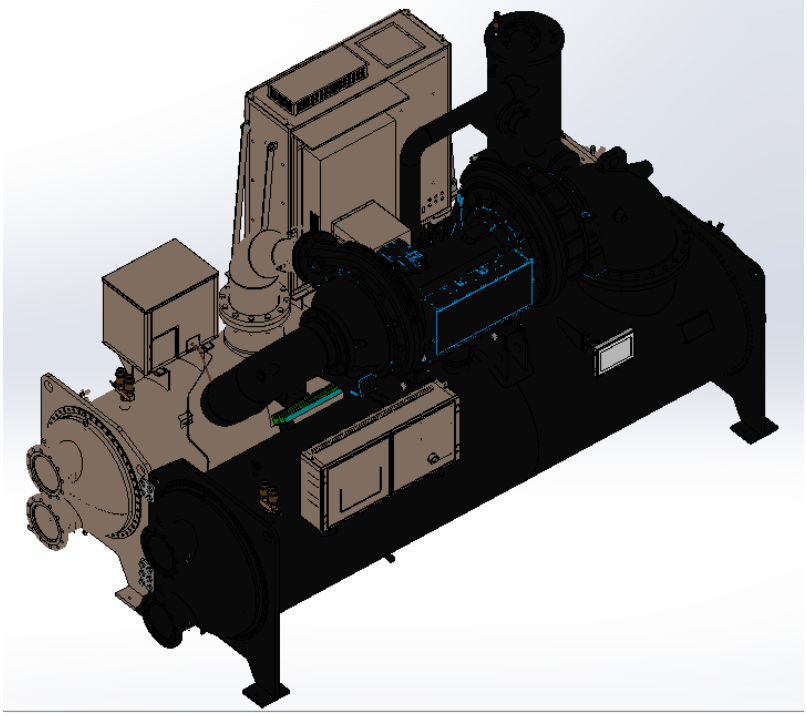


Fig. 3-17 The typical insulation diagram of WMTC chiller

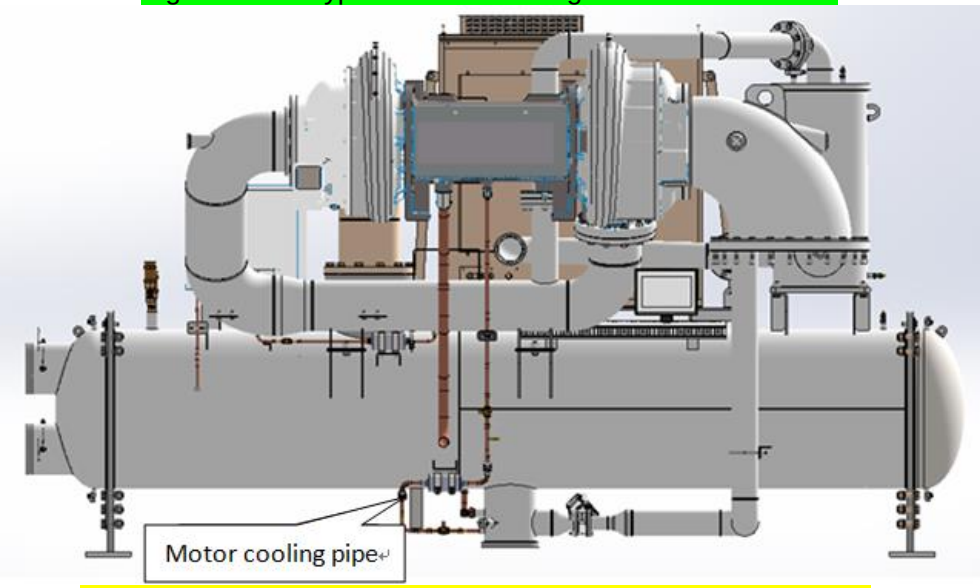


Fig.3-18 The auxiliary pipes schematic drawing of WMTC chiller

4 Commissioning and Operation

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 factory training for DAIKIN centrifugal operators every year, the 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.

4.1 Before startup

In order to keep safe, please make sure the below items has been confirmed before first time startup.

4.1.1 Confirmation of the wirings

① Please check all the wirings before power on.

② The type of power supply must meet the requirements of relevant standards. The maximum voltage fluctuation range is ±10% of the rated voltage of the unit, and the grid frequency fluctuation range is ±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 ⩽ 5% .

③ Power on: Make sure the power switches of VFD and control panel are off before power on. Then switch on the upper switch and measure the voltage between every two phases, the voltage should meet the requirement. Close the switch of VFD and measure the output voltage between every two phases, the voltage should be same as the power supply.

Then close the switch of control panel, check the controller and the data displayed on the HMI. If any data on HMI is not correct, please find the root course and fix the problem according to the electric schematic.

Caution

If the chiller has stood by for more than six month, the above confirmation should be taken before start up the chiller.

Warning

The unbalance of the voltage should be within 2%.

4.1.2 Confirmation of the chiller

① Check the valves on the chiller

There are several valves installed on the chiller for maintenance. These valves should be opened by DAIKIN service person before first start up.

The location and quantity of the valves are as below:

Table 4-1 Valves installed on chiller

Location	Type of valves	Quantity
Motor cooling pipe	Ball valve	2
Suction pipe of purge unit	Stop valve	1
Drain pipe of purge unit	Stop valve	1

② Check the MBC control box

A. Please check the wirings on the MBC box and make sure all the wirings have been fastened.

B. The MBC box has been filled with dry nitrogen (the pressure is about 7kPaG) before delivering to the customer side. Once the MBC box need to be opened at the service site (such as magnetic bearing calibration), Please check the leakage of MBC box according to section 5.4.2.

4.1.3 Confirmation of the water system

Check the water pipes connected to the chiller. The direction of the water flow should be same as chiller design and all the components should be installed at the correct direction. Check all the valves, make sure all the valves are at the correct position.

WMTC chiller is shipping without any water, and the drain valves on the water head of vessel are full open before shipping. Please close the valves before filling water.

Please exhaust the air by using the vent valves on the top of pipes when the pumps start to operation. The valves on the top of chiller water head are used to exhaust the air inside the water head. Open the valve slowly to let the air flow out from the water head, when the air has been fully exhausted, the water will flow out through the valve, then close the valve.

Check the flow rate of the evaporator and condenser to make sure the flow rate is same as chiller selection. If there is no flow meter, suggest to use the pressure drop to estimate the flow rate. When the pressure drop of the chiller is same as selection, means the flow rate is enough. Then check the flow switch, normally all the flow rate listed on the selection can make the flow switch close. If the flow switch is provided by customer, the above requirements should also be satisfied.

●Confirmation of the chilled water system

All the centrifugal chillers have a minimum operation capacity, when the actual required capacity is lower than this, the chiller will keep running at the minimum capacity and standby if the leaving water temperature is too low. Thus, DAIKIN suggest to use a water tank for chilled water. This water tank is used to temporary store the extra cooling capacity of the chiller to prevent the chiller on and off too often.

Please take 4.5.4 as reference to get the suggestion of the minimum volume of the water tank. The volume of the tank is the calculated total water volume minus the water volume inside the water pipes.

Variable primary flow rate (VPF) system is used to decrease the power consumption of chilled water pump to improve the total system efficiency. But surge will happen if the chilled water flow rate changes too fast. DAIKIN suggest to limit the changing rate of the flow lower than 30% per minute.

The chiller controller provide the chilled water pump contact, customer can use this contact to run the pump together with compressor. Please see Fig 3-12 to get the wiring and requirement.

If customer uses BMS to control the chilled water pump, before chiller start up, please make sure the water pump has operated and the flow rate is stable.

Caution

For BMS application, please make sure the timing for chiller start up is at least 3 minutes later than the timing for water pump start up.

●Confirmation of the condenser water system

Condenser water temperature is important for chiller efficiency. If temperature fluctuation is inescapable during operation, please make sure the temperature fluctuation rate is lower than 2°C/min.

Normally the chiller efficiency will decrease if the flow rate of condenser decreased. But the total efficiency of the system may get improvement because of the decrease of the power consumption of condenser water pump. For variable condenser flow rate system, it is important to follow the minimum flow rate on selection paper, because excessively low condenser flow rate will lead to chiller unstable and pipe scaling. The changing rate of condenser flow should also lower than 30% per minute.

The flow rate of the cooling tower should same as chiller selection. Normally, lower condenser water temperature is beneficial for chiller efficiency. So when the ambient wet bulb temperature is

lower than design, we can get higher chiller efficiency. But in another way, we need to make the cooling tower fan fully open to decrease the condenser water temperature. In this case, the power consumption of cooling tower may be very high. So even the chiller efficiency increased, but the total efficiency of the system may be not at sweat point.

For this kind of application, DAIKIN suggest to use cooling tower control. When the ambient wet bulb temperature is low, shut down some of the fans to save power.

As some of the inner cycle of chiller need to be driven by the temperature differential between condenser and evaporator, so for the lower ambient wet bulb temperature, the chiller may cannot running at this condition. In this case, the bypass control of the condenser flow is important.

Fig. 4-1 shows the typical condenser flow bypass system. When the ambient wet bulb temperature is too low, open the three-way valve to bypass some of the flow to control the condenser water temperature.

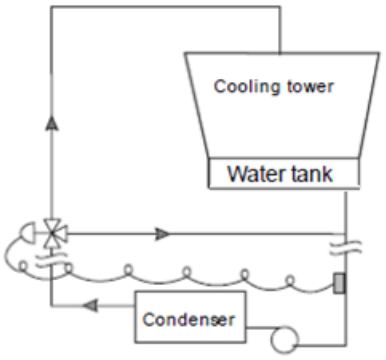


Fig. 4-1 Typical condenser water bypass system

4.1.4 Confirmation of purge unit

For the purge unit, please check the items below before first start up:

① Check if all valves connected with the inlet gas pipeline and liquid drain pipeline are all opened;

② The wirings of the purge unit has been done before shipping, it is not required to do any wiring at customer side. DAIKIN service person will confirm the items below before first start up:

1) Check the wirings in control box, make sure all the connections are fastened，the detailed wiring diagram of the purge unit please refer to Appendix D;

2) Close the power switch of the purge unit in control box, then the touch screen will be powered on;

3) Check all the temperature and pressure parameters are normal displayed, no alarm appeared;

③ Confirm “Local” control is selected in the “Set” screen.

4.2 Introduction and operation of HMI

WMTC chillers are equipped with the DAIKIN MicroTech control system which contains all monitoring, control functions, demand of chiller and microprocessor for ensuring its effectively operation. The control system is comprised by below items:

1. Human Machine Interface (HMI): Used to display all the operation parameters and all the settings.

2. Programmable Logic Controller (MicroTech V): Used for all control function and the communication with other controllers. This controller also has a small interface for service person to check and change the settings.

The logic of these components is shown as Fig.4-2:

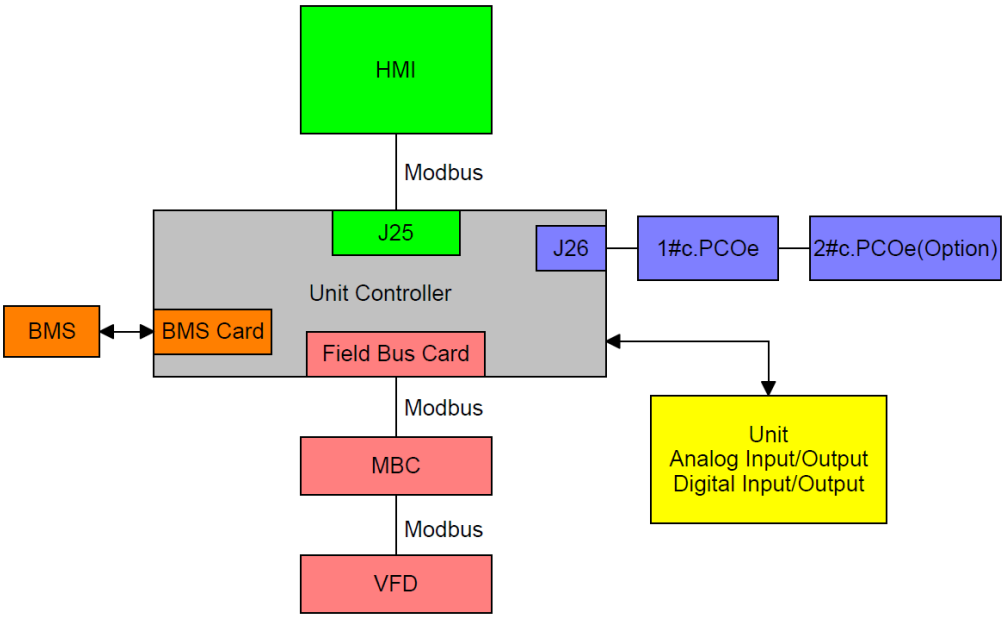


Fig. 4-2 The WMTC Controller control logic

The power supply of the HMI and controller has been done before shipping, so when the main power is on, the controller will boot automatic and the HMI will power on.

The interface of the WMTC chiller is shown as Fig.4-3:

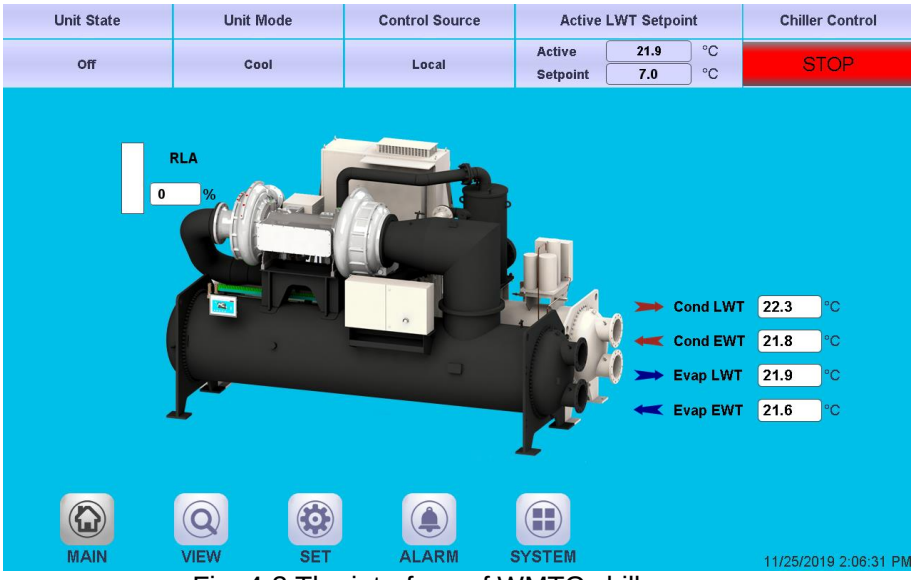


Fig. 4-3 The interface of WMTC chiller

Click the button at the bottom of the HMI to access the different pages:

MAIN: This page shows the major operation information of the chiller.

VIEW: This page shows the detailed operation information of the chiller, including the pressure, temperature and speed. Click the compressor to see the detailed information of the compressor. Click the input/output button to see the input and output signals.

SET: This page is used for changing the settings of the chiller.

ALARM: This page shows the active alarm and alarm history.

SYSTEM: This page is used to show the system information including software version, this page also have the user login entrance.

Customer can get all the parameters and the history by HMI. The control system monitoring all the feedback and make the chiller operated at the optimal situation. When one of the parameters is going to exceed the normal range, the controller will give the pre-alarm and change the moveable components to pull the chiller back to normal operation. If one of the parameters has already exceeded the normal range, to prevent damage, the controller will shut down the chiller and send the alarm information to HMI. Same as the operation parameters, the above alarm information also will be recorded in the HMI, the information is used to find out the root cause of the alarm.

Different user has different permission. If you need to get more information or change the high level settings, please login the high level username.

Get more information about the HMI and controller from “Z8100315 WMTC OMM”.

4.3 Initial start up

4.3.1 Preparation

Before start up the chiller, check the safety settings and confirm the situation of all components.

Confirm the parameters

After power on, check all the parameters of the sensors:

1. The pressure of the vessels should be same as the saturated pressure of the water temperature.
2. All the water temperature should be same as the temperature feedback from the water temperature sensor from water system.
3. All the stator temperature and the gap sensor temperature should be the same.
4. All the temperature of the refrigerant should be the same.

If anyone of the sensors has different reading, please check the sensor. First, check the wirings and the sensor, then use the HMI to correct the wrong reading.

Confirm all the settings are correct. Correct settings are the guarantee of chiller operation. Please see the appendix F to get the main settings.

Customized chillers may have different settings. Please contract DAIKIN to get more information.

Caution

Even for the customized chillers, the settings have been defined to optimum value. It is necessary to get permission before changing the settings.

The follow table shows the main settings of WMTC standard chiller:

Table 4-2 Main settings for WMTC standard chiller

Description	Default	Adjustable range
Water		
Leaving Water Temp - Cool	7.0°C	3.0 - 18.0°C
Startup Delta T	1.7°C	0.0 - 5.6°C
Stage Delta T	0.6°C	0.0 - 5.6°C
Shutdown Delta T	1.7°C	0.0 - 1.7°C
LWT Reset Type	NONE	NONE, RETURN, 4-20mA
Maximum Reset Delta T	0.0°C	0.0 - 11.2°C
Start Reset Delta T	5.6°C	0.0 - 11.2°C
Mode		
Unit Enable	OFF	OFF, Auto
UNIT Mode	Cool	NA, Cool, Ice
Control Source	Local	Local, Switches, BAS
Evaporator Pump	Only #1	Only #1, Only #2, Auto, #1 Primary, #2 Primary

Condenser Pump	Only #1	Only #1, Only #2, Auto, #1 Primary, #2 Primary
Motor		
Demand Limit	OFF	OFF, ON
Minimum Amps	5%	0 to 20%
Maximum Amps	100%	10 to 100%
Nameplate RLA	120Amps	85 to1000Amps
Alarm		
Low Suction Pressure - Stop	48kPa	42 - 54kPa
High Discharge Pressure - Stop	237kPa	183 - 293kPa
High Discharge Temperature - Stop	60°C	60 - 90°C
Surge Temperature Limit	7°C	1 - 14°C
Surge Slope Limit	11°C/min	1 - 55°C/min
Motor Current Threshold	3%	3 - 20%
High Stator Temp - Stop	55°C	48 - 80°C
Evaporator Freeze Protect	1.1°C	-22.7 – 7.2°C
Condenser Freeze Protect	1.1°C	-22.7 – 7.2°C
Timer		
Evap Recirculate Timer	0.5min	0.2 to 5min
Start to Start Timer	5min	2 to 60min
Stop to Start Timer	3min	1 to 20min
Unload Timer	30s	10 to 240s

Components test

WMTC chillers have been completely tested before chipping to jobsite, so the components testing only apply to alarm occurred; the test can only be done by certified DAIKIN service person.

Login as service person, click the “System” to the test page which is shown as Fig.4-4:

Fig. 4-4 The test page of WMTC chiller

A. EXV testing

Change the EXV control mode from “Auto” to “Manual”, the EXV will stop at the default position 0% (full close).

Change the EXV position to 100%, check the movement of the EXV from the pointer on the top of the EXV driver. The EXV should open form 0% to 100% smoothly and stop at full open position.

Then change the EXV position to 0%, the EXV will move from 100% to 0%. EXV driver needs about 30 seconds to finish one cycle from 0% to 100%.

If there is no issue during the test, means the EXV is reliable. Change the EXV control mode from “Manual” to “Auto”.

B. IGV movement testing

Normally the IGVs for both first stage and second stage will finish calibration automatically after chiller power on. If there is no alarm during the calibration, means the IGV movement is stable. If alarm occurred, click the “IGV calibration” button to find out the root cause.

Recording before the initial startup

The above items should be done before initial startup, every longtime standby and every time after maintenance. Please put the result into the form below:

Table 4-3 Check list before initial startup

Item	Yes	No
Ⅰ Chilled water system		
Pipes connected correct		
The air has been completely exhausted and pipes are full with water		
Water pump installed correct (rotation direction has been confirmed)		
Valves installed correct and operation without alarm		
Water flow is stable and within the range (record the value)		
Ⅱ Condenser water system		
Pipes connected correct		
The air has been completely exhausted and pipes are full with water		
Water pump installed correct (rotation direction has been confirmed)		
Valves installed correct and operation without alarm		
Water flow is stable and within the range (record the value)		
Ⅲ Chiller		
Relief valves have been connected to outdoors correct		
Motor cooling valve full open		
EXV movement is correct		
IGV calibration succeed		
Temperatures and pressures on HMI are correct		
No alarms on HMI		
Safety settings have been confirmed		
Purge unit operated normally		
Ⅳ Electric		
The field wiring has connected to control box		
The power cable for starter and compressor has been connected correct		
All the control wirings have been connected correct		
Starter current satisfy the requirement		
Power cable for pumps has been connected correct		
Power cable for cooling tower has been connected correct		
Ⅴ Shaft float test		
Shaft float without any alarm		
Chiller ready to start according to correct procedure		
Ⅵ Purge unit		
Purge unit control mode is correct		

4.3.2 Chiller startup

Start and run the chiller after all the above items have been confirmed.

Caution

The initial startup of DAIKIN chillers should be done by DAIKIN service person. DAIKIN will not be responsible for any damage caused by customer.

There is a “Stop” button at the top right corner of “VIEW” interface, which is shown in Fig.4-5. Click this button and choose the “Auto” mode, the chiller will start up follow the normal procedure.

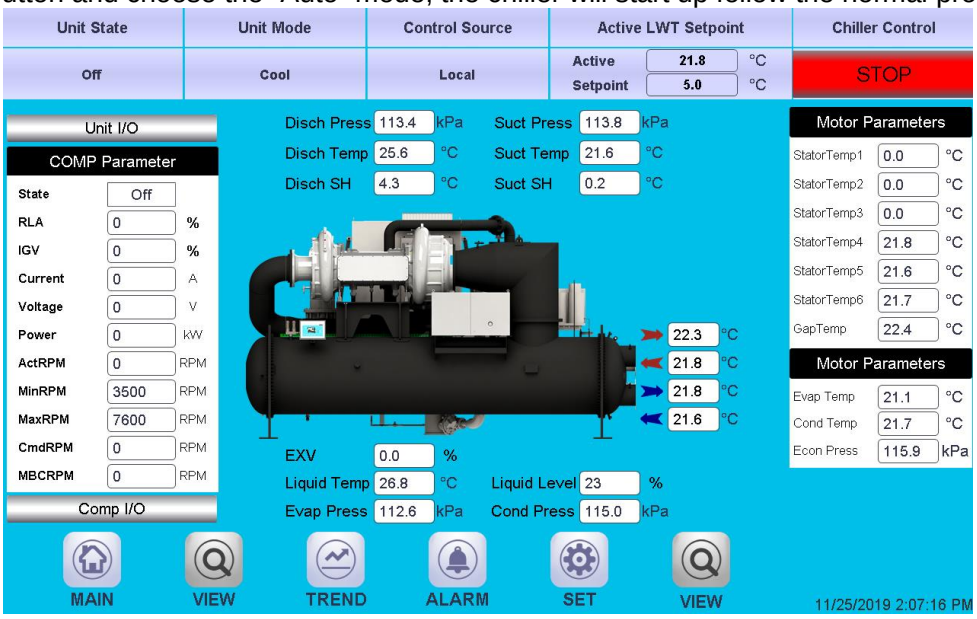


Fig. 4-5 The “VIEW” interface of HMI

After chiller start up, the MicroTech V system will control the components to operate the chiller stable and provide the required chilled water. As the load of the chiller will increase for some time, operator can check the chiller if there is any abnormal noise, vibration and alarm.

When the chiller is in stable operating state, please check the parameters from HMI:

1. The evaporator saturated temperature is 0.3~0.8°C lower than the outlet chilled water temperature.
2. The condenser saturated temperature is 0.5~1.2°C higher than the outlet condenser water temperature. If the condenser saturated temperature is exceed the normal range at first time operation, non-condensable gas maybe one of the reason. Please start up the purge unit.
3. The motor stator temperature and gap temperature should be lower than 45°C.
4. The actual speed is not lower than minimum speed and the IGV position is correct.
5. Check the sight glass of the evaporator and the condenser to confirm the liquid level inside the vessel. Check the float valve inside the economizer to see if the float valve is jammed or not.
6. Follow the “Z8100315 WMTC OMM” to check all the parameters and functions of the HMI.

If any of the parameters is abnormal, or any alarm occurred during operation, please shut down the chiller and find the problem according to the trouble shooting. It is forbidden to restart the chiller without fix the issue.

4.3.3 Purge unit startup

The purge unit can be startup by selecting “ON” button on the “Main” screen of the touchscreen after finish all checking and setting. Please refer the chapter 5.2.3 for detailed introduction.

4.4 Stop the chiller

After all the parameters have been confirmed, stop the chiller by the following ways:

1. Click the “Auto” button on the HMI and choose “Stop”, the chiller will shut down automatically

according to the default procedure. In this case, the compressor will not stop immediately but unloading first. Then shut down when the stop conditions have been satisfied. Because of the inertia, the compressor will continue rotate after lose power. The magnetic bearing will continue provide buoyancy force until the compressor speed decrease to zero.

2. If there is no demand from customer side, the chiller will operate at minimum capacity and shut down automatically when the outlet temperature of chilled water is too low.
3. Another way to stop the chiller is to use the manual switch in the control panel. If customer turns off this switch, the compressor will shut down immediately.

Caution

Unless emergency, it is forbidden to use manual switch or emergency button to stop the compressor.

4.5 Chiller operation range

To ensure the chiller operating stable, operator should keep the actual water temperature within the chiller operation range.

Caution

The following operation range is only for standard WMTC chiller, if the actual temperature is likely to exceed the range, please contract DAIKIN local service to get support.

DAIKIN will not take response for any damage caused by condition out of range.

4.5.1 Water flow rate range

The flow rate of the water affects the chiller efficiency and stability. If the flow rate is too low, the water flow cannot be turbulent flow and the heat transfer efficiency will decrease. If the flow rate is too high, the tubes may be damaged by the vibration caused by water flow. And the power consumption of the water pump will increase a lot because of the pressure resistance increased.

The standard flow rate and minimum limitation are shown on the selection paper. Please contact the DAIKIN local service to get the maximum limitation. The VFD driver of the pumps should be correct set to keep the flow rate always within the range.

For VPF and VCF application, please also confirm the change rate of water flow should less than 30% per minute.

4.5.2 Minimum volume for chilled water system

The chiller's minimum operation load is shown on the selection paper, once the actual demand is lower than the minimum load, the outlet temperature of chilled water will decrease to shut down temperature. In this case, the chiller will shut down and restart until the chilled water temperature increase to startup temperature. So higher total volume of the chiller water system can help to store the extra cooling capacity and prevent the chiller on/off too often.

The minimum volume of the chilled water system is calculated as below:

$$Q\ (m^3) = (T \times 60) \times H / (\Delta t \times C_p \times \rho)$$

T：Minimum operation time of compressor (min), take 5min for calculation;

H：Minimum chiller operation cooling capacity (kW), shown on the selection paper;

Δt：Allowable chilled water fluctuation value, equal to 3.4°C;

C_p：Specific heat capacity of water (kJ/kg °C)

ρ：Density of water (kg/m^3)

4.5.3 Environment and power supply

Standard environment and power supply of WMTC chillers is as below:

Table 4-4 Environment and power requirement

Power supply voltage	Rated voltage ±10%
Voltage unbalance	≤2%
Frequency	Rated frequency ±2%Hz
Environment temperature	3-40°C

Relative humidity(note)	According to ELWT≥5°C，environment temperature 10-32°C: allowable maximum relative humidity for standard insulation(20mm) is 70%
Atmospheric corrosive gas contents	Sulfur dioxide: ≤10 mg/m^3
	Hydrogen fluoride: ≤5 mg/m3
	Hydrogen sulfide: ≤5 mg/m3
	Nitrogen oxides: ≤5 mg/m3
	Nitrogen: ≤1 mg/m3
	Hydrogen chloride: ≤5 mg/m3
Location	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 side pressure	1.0MPa (Can be special design based on customized requirement)

Note：
If the actual relative humidity at the site exceeds the standard range, the chiller insulation should be customized as below:
Maximum allowable relative humidity for 25mm insulation is 73%;
Maximum allowable relative humidity for 40mm insulation is 80%;
Contact DAIKIN local office to get more support if the actual relative humidity is higher than 80%.

4.5.4 Water quality

The water quality has big affection on chiller efficiency and life time, so the water quality must satisfy the requirement. The water quality should be confirmed before chiller installation, during chiller operation, the water quality should also be monitored and well managed.

The quality requirement is as below:

Table 4-5 Water quality requirements

Item		Unit	Standard value	affection	
				corrosion	Scaling
Basic items	pH（25°C）	—	6.5~8.0	O	O
	Conductivity（25°C）	μs/cm	＜800	O	O
	Cl^-	mg（Cl^-）/L	＜200	O	
	SO_4^{2-}	mgSO_4^{2-}/L	＜200	O	
	Acid consumption（pH=4.8）	mg($CaCO_3$)/L	＜100		O
	Total hardness	mg($CaCO_3$)/L	＜200		O
For reference	Fe	mg（Fe）/L	＜1.0	O	O
	S^{2-}	mg(S^{2-})/L	None	O	
	NH_4^+	mg(NH_4^+)/L	＜1.0	O	
	SiO_2	mg(SiO_2)/L	＜50		O

Note:
1. For the water quality, please take GB/T 18430.1 appendix D as reference;
2. The affection marked with “O” means this kind of affection may happen;

3. If the actual water quality cannot satisfy the requirements, please take GB50050 as reference to purify the water.

If customer uses other liquid as secondary refrigerant, the chiller must customized design to meet this requirement. The actual liquid should same as the selection paper and customer need to monitor the quality of the liquid.

Caution

1. Do not drink chilled water or condenser water.
2. DAIKIN will not be responsible for any damage caused by unsatisfactory water.
3. Please drain the water from vessel and pipes if chiller need to standby for more than one month, fill the vessel with nitrogen to prevent corrosion.

5 Purge Unit

5.1 System introduction

5.1.1 System composition

The purge unit mainly composed by the non-condensable gas separation system and the R404A refrigeration system:

① Non-condensable gas separation system: mainly include R1233zd(E)/non-condensable gas inlet pipe with solenoid valve that connected with the Chiller condenser, R1233zd(E) liquid drain pipe with solenoid valve that connected with the Chiller evaporator, the discharge pipe with solenoid valve that connected with the vacuum pump, purification tank, temperature/pressure sensors and other valves.

② R404A refrigeration system: mainly include compressor, air-cooled condenser(ACC), constant expansion valve(CEV), evaporation coil, temperature/pressure sensors and other valves.

5.1.2 Working principle

The inlet of the purification tank is connected to the top of Chiller condenser, it is used to suction the refrigerant which is mixed with non-condensable gas. The outlet of this tank is connected to the evaporator in order to drain the refrigerant liquid back to chiller. The vacuum pump is used to exhaust the non-condensable gases from the tank. The R404A refrigeration system of the purge unit provides continuous low temperature to condensate the vapor refrigerant inside the tank. The working principle diagram of the purge unit is shown in Figure 5-1.

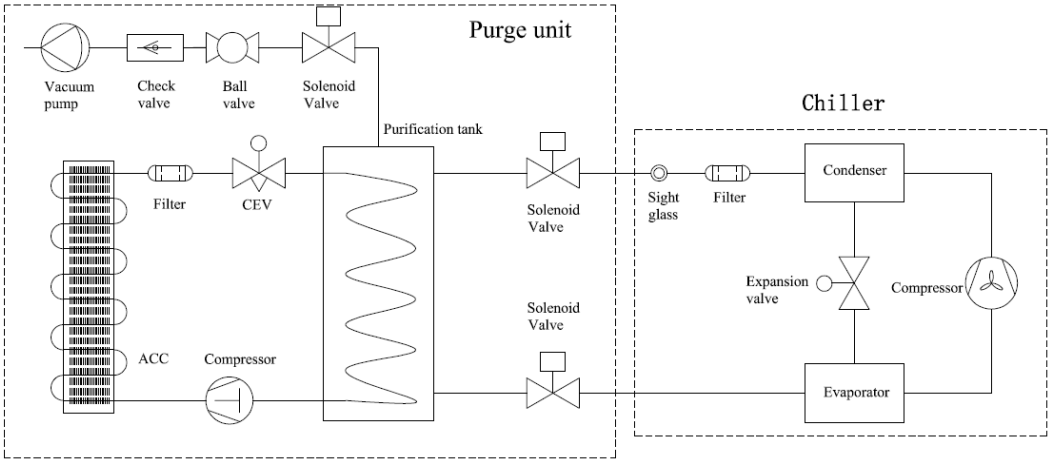


Fig. 5-1 The purge unit working principle

5.2 Operation

5.2.1 Operation model

The purge unit can operation alone no matter if the chiller is run or not. The customer can view the current operating model through the purge unit HMI screen. The main operating models are included:

① Run

The components (such as compressor, air-cooled condenser fan) of the purge unit refrigeration cycle will run to provide continuous low temperature to condensate the vapor refrigerant inside the tank. In this model, the customer can set manual model to force the purge unit in “purge” model in the “Set” screen.

② Purge

If there is much air in the purge tank or set in “Manual” model when the purge unit in “Run” model, the purge unit will transfer to “Purge” model. In this state, the purge unit will judge the composition percentage of the liquid and air in purge tank based on the sensor data. If there is much liquid detected, the liquid drain solenoid valve will open and then run the vacuum pump, this will discharge the air to the atmosphere intermittently. Else, the vacuum pump will start directly to discharge the air.

③ Standby

If there is little air in purge tank, the purge unit will transfer to “Standby” model. In this model, the compressor and air-cooled condenser fan of the purge unit will stop run. In this model, the purge unit will transfer to “Run” model based on the judgement of the atmosphere temperature and the standby time set in the program.

④ Stop

When the purge unit has fault or set “OFF” in main screen, the purge unit will transfer to “Stop” model.

5.2.2 HMI Operation

The purge unit configured with one 7inch color touch screen for control the purge unit ON/OFF, setting parameters, viewing operation status and alarm information et al. There are four functional options listed in the bottom of the main display screen: “Main”, “Set”, “Status” and “Fault”. The customer can touch each functional option to enter the desired screen. The detailed description of the four options is below:

① Main

The main screen will display when the purge unit is powered on, it is shown as Figure 5-2:

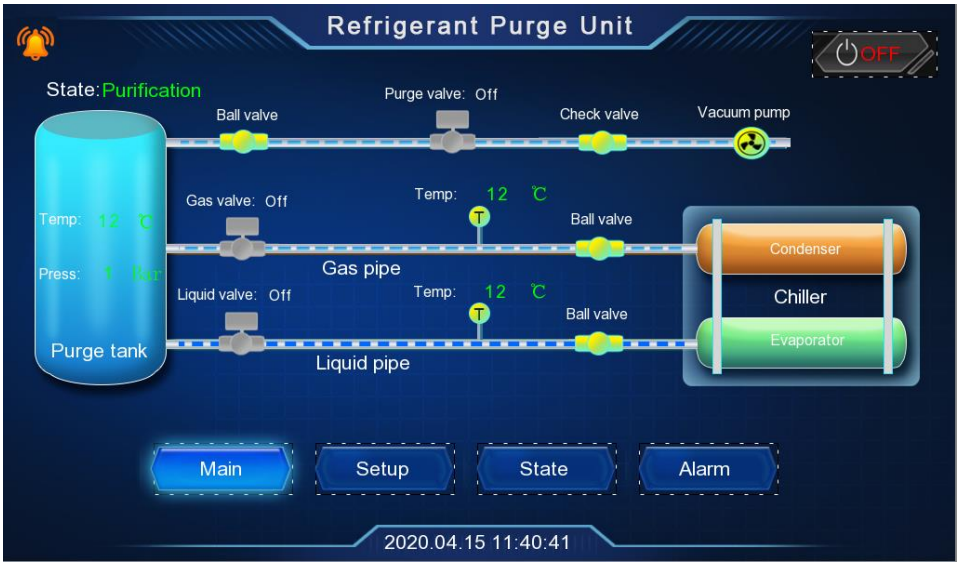


Figure 5-2 “Main” screen

The information showed on “Main” screen is below:

1) If the purge unit has alarms, the flashing bell will appear on the upper left corner; else, there is no flashing bell;

2) On the upper right corner, the customer can start or shut off the purge unit by selecting the “ON” and “OFF” respectively. The current operation model is also displayed on the top of purge tank;

3) The purge unit working principle diagram is displayed in the “Main” screen, the name and state of the vacuum pump, valves, flowing status of the pipeline and sensor data.

The explanations of each icon shown on the HMI screen are listed in Table 5-1.

Name	State	Display	Icon	Note
Solenoid valve of inlet gas pipe	Open	Open		The valve is open
	Off	Off		The valve is close
Solenoid valve of Liquid drain pipe	Open	Open		The valve is open
	Off	Off		The valve is close
Solenoid valve of gas discharge pipe	Open	Open		The valve is open
	Off	Off		The valve is close
Vacuum pump	On	On		The icon spin dynamically
	Off	Off		The icon not spin dynamically
Start/Stop of Purge unit	On	On		Start the Purge unit
	Off	Off		Stop the Purge unit
Flow pipe	Open	-		Show the actual flow direction dynamically
	Close	-		The icon keep static
Warning bell	Fault	-		The bell flashing
	Normal	-	–	No bell

Note: The maintenance valve/ check valve are default “open”.

② Setup

The setup screen will show when the customer select the “Setup” function, it is shown as Figure 5-3.

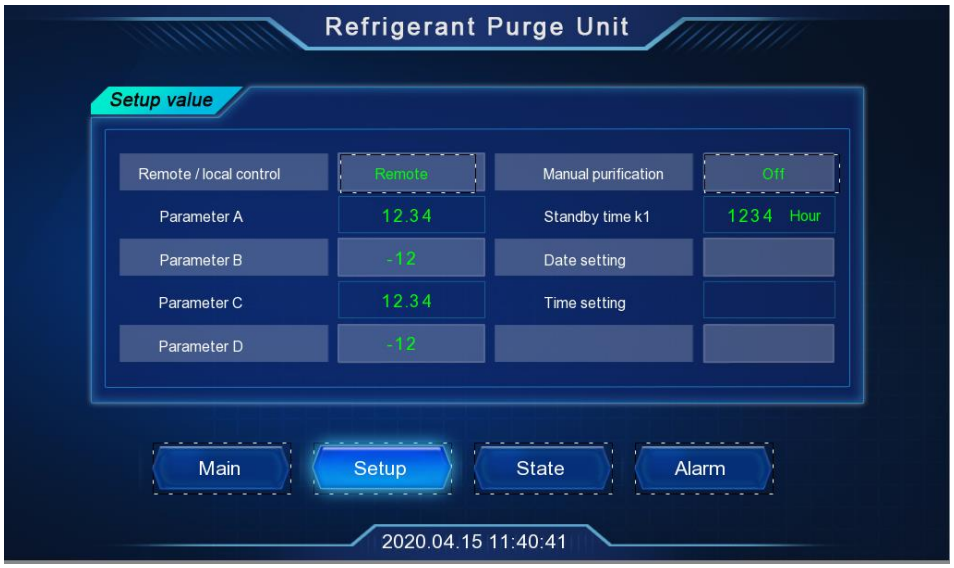


Figure 5-3 “Setup” screen

The main information showed on “Setup” screen is below:

1) Remote/Local control: the control model of the purge unit can be set as “Remote” or “Local”

, the default is “Local” control;
2) Manual model: when the purge unit in “Run” operation model, it can be forced to “Purge” operation model by this setting function;
3) Suction temperature coefficient a/b, purge tank temperature coefficient a/b and standby time k1 are default control parameters.
4) Time setting: the current date and time is shown at the bottom of each screen, it should be correctly set when the purge unit operation at the first time.

Caution

1. For the “Manual model” and “Time setting”, the customer or DAIKIN authorized service engineer are allowed to change the setting based on the actual operation condition of the purge unit, other parameters are not allowed to change without permission to avoid influence the normal operation;
2. The time should be set correctly to make sure the time record is right if the purge unit has fault.

③ State

The state screen will show when the customer select the “State” function, it is shown as Figure 5-4.

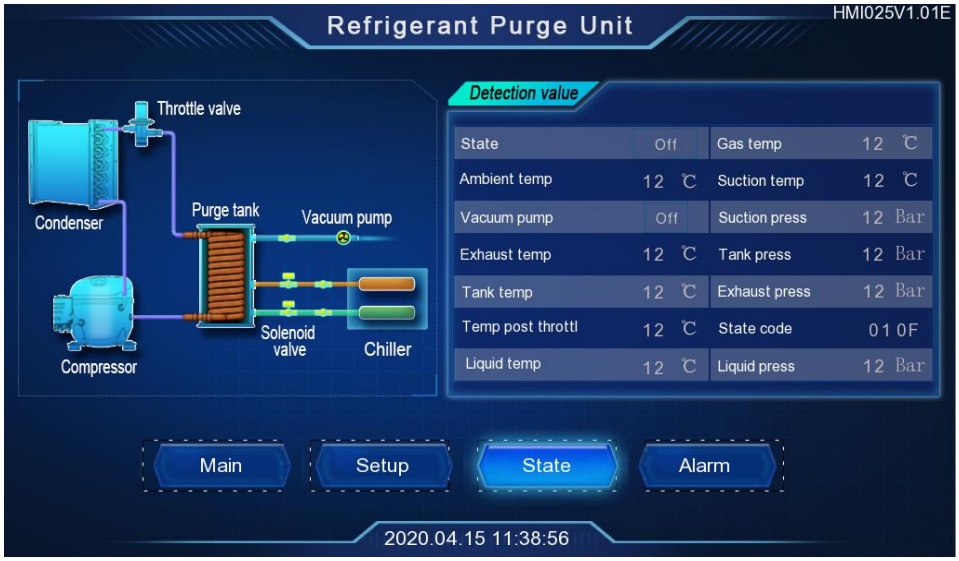


Figure 5-4 “State” screen

The main information showed on “State” screen is below:
1) The purge unit refrigeration cycle with main components are showed on left side and the operation parameters, operation model are showed on right side;
2) “Low pressure” refers to suction pressure and “High pressure” refers to discharge pressure of purge unit compressor, both are gauge pressure;
3) “Temperature after the valve” refers to temperature after the expansion valve of purge unit;
4) “State password” is used for service engineer.

④ Alarm

The alarm screen will show when the customer select the “Fault” function, it is shown as Figure 5-5.

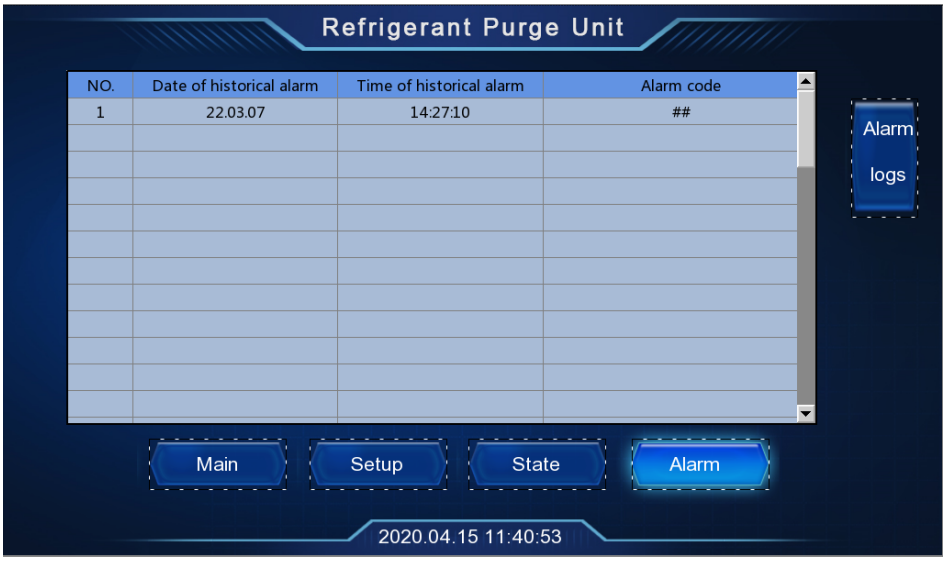


Figure 5-5 “Fault” screen

This page mainly showed the information of the current fault and occurred time. On the right side, the customer can touch the “History fault” to inquiry the historical alarm occurred during the past operation of the purge unit, it is very helpful for diagnose and maintance of the purge unit. For the detailed common faults and troubleshooting methods, please refer to 5.3.4.

5.3 Maintenance

Caution:

Some of the operations may need to touch the refrigerant. To protect yourself, please obey with the safety guidance of the labels and the refrigerant material safety datasheet to avoided the possibly injury.

Warning:

① Before the maintenance operation, the power should be off to avoid the personal and equipment injury;

② Don’t touch the high temperature components, such as compressor house, discharge pipe et al by your hand directly to avoid scald;

③ Don’t touch the low temperature components, such as suction pipe, expansion valve et al by your hand directly to avoid cold injury;

To ensure the purge unit operation stable and efficient, the purge unit should be scheduled maintenance, mainly include every month, every half a year and daily maintenance.

5.3.1 Every month

Check the humidity indicator. The humidity indicator is installed on the sight glass on suction pipe. If the humidity indicator shows the humidity is too large, please exchange the dry filter.

① Humidity monitoring

One dry filter and one sight glass are installed on the suction pipe for each purge unit. Customer can get the humidity from the humidity indicator installed in the sight glass.

The sight glass should be scheduled checked. The humidity indicator will show “Wet” if the humidity of the refrigerant is too large. If the humidity indicator continuous shows “Wet” for more than three days, means the dry filter has full with water and need to be replaced. If the humidity

indicator shows “Wet” very often, means the vapor has mixed into the chiller.

The humidity indicator shows different situation according to different environment temperature as below:

Table 5-2 Relationship between humidity and temperature

Temperature(°C)	Dry	Normal	Wet
24	<5ppm	5-15ppm	>15ppm
38	<10ppm	10-30ppm	>30ppm
52	<20ppm	20-50ppm	>50ppm

Note: PPM means millionth.

After replaced the dry filter, run the purge unit for more than 72 hours and then use humidity indicator to confirm the humidity.

② **Replace the dry filter**

Please follow the below steps to replace the dry filter:

1. Press the “Off” button on the upper right of “Main” screen to shut down the purge unit.
2. Close the stop valves on the suction and drain pipe to isolate the purge unit from chiller.
3. Disassemble the dry filter by proper tools.
4. Re-install a new filter to the pipe and fasten the connection by tools.
5. Re-open the stop valves.
6. Press the “On” button on the “Main” screen to run the purge unit.

Caution

For a little amount residual refrigerant in the pipe, please be careful during the operation process.

5.3.2 Every half a year

Check the air-cooled condenser to see if the condenser has been blocked by the dust. In this case, the condenser needs to be cleaned by compressed air.

5.3.3 Daily maintenance

During the daily operation of the purge unit, the customer should also pay attention to the air-cooled condenser fan, unit compressor and the sensor display, if there are any strange noise, vibration or un-normal display, please stop the purge unit for checking.

5.3.4 Common issues

The purge unit will stop when the fault occurred during the running. The detailed fault code and fault note can be viewed on the “Alarm” screen. The common issues and countermeasures are listed in table 5-3.

Table 5-3 Common issues and countermeasures of Purge unit

No.	Fault Code	Note	Possible Reason	Countermeasures
1	H1	Air separation temperature sensor fault	① Wiring open ② Short circuit	① Check the wiring ② Replace the sensor
2	H2	Inlet gas temperature sensor(RT6) fault	① Wiring open ② Short circuit	① Check the wiring ② Replace the sensor
3	H3	Liquid drain temperature sensor(RT5) fault	① Wiring open ② Short circuit	① Check the wiring ② Replace the sensor
4	H4	Ambient temperature sensor(RT8) fault	① Wiring open ② Short circuit	① Check the wiring ② Replace the sensor
5	H8	Vacuum pump fault	① Vacuum pump has malfunction ② Purge pipe has leakage	① Set the purge unit in “Manual” model, check if the purge unit works normally in 60s; ② Check if the purge pipe has leakage point，if yes，please repair.

6	E1	R404A system high pressure fault	① The fan of air cooling unit run un-normally ② The air cooling condenser is blocked ③ The ambient temperature is too high	① Check if the air cooling unit run normally ② Clean the fin of the air cooling condenser ③ Check if the ambient temperature is higher than 48℃（Dry bulb）
7	E2	R404A system low pressure fault	① The constant pressure valve blocked ② The ambient temperature is too low	① The purge unit discharge pressure should be higher than 800kPa if the constant pressure valve is OK ② Check if the ambient temperature is lower than 4℃(dry bulb)
8	E4	R404A system low pressure sensor (V1) fault	① Wiring open ② Short circuit	① Check the wiring ② Replace the sensor
9	E5	Low pressure sensor (VI2) fault	① Wiring open ② Short circuit	① Check the wiring ② Replace the sensor
10	E6	High pressure sensor（VI3） fault	① Wiring open ② Short circuit	① Check the wiring ② Replace the sensor
11	E7	R404A system discharge temperature high fault	① The fan of air cooling unit run un-normally ② The air cooling condenser is blocked ③ The ambient temperature is too high	① Check if the air cooling unit run normally ② Clean the fin of the air cooling condenser ③ Check if the ambient temperature is higher than 48℃
12	F1	R404A system discharge temperature sensor(RT1) fault	① Wiring open ② Short circuit	① Check the wiring ② Replace the sensor
13	F3	Suction temperature(RT11) sensor fault	① Wiring open ② Short circuit	① Check the wiring ② Replace the sensor
14	F6	R404A system low pressure high	① The constant pressure valve fault ② The ambient temperature is too high	① Check if the constant pressure valve work normally ② Check if the ambient temperature is higher than 48℃（Dry bulb）
15	NE	No fault	—	—

6 Maintenance

6.1 R1233zd (E) temperature-pressure contrast

Table 5-1 R1233zd (E) temperature - saturated pressure table

R1233zd(E) temperature - saturated pressure table							
°C	kPa	°C	kPa	°C	kPa	°C	kPa
-15	-77.60	7	-36.44	29	48.13	51	200.81
-14	-76.38	8	-33.70	30	53.39	52	209.83
-13	-75.10	9	-30.88	31	58.79	53	219.05
-12	-73.78	10	-27.96	32	64.33	54	228.48
-11	-72.40	11	-24.95	33	70.02	55	238.12
-10	-70.97	12	-21.84	34	75.87	56	247.97
-9	-69.48	13	-18.62	35	81.86	57	258.03
-8	-67.93	14	-15.31	36	88.01	58	268.32
-7	-66.32	15	-11.90	37	94.32	59	278.83
-6	-64.65	16	-8.37	38	100.79	60	289.56
-5	-62.91	17	-4.74	39	107.42	61	300.52
-4	-61.11	18	-1.00	40	114.22	62	311.71
-3	-59.24	19	2.85	41	121.19	63	323.13
-2	-57.31	20	6.82	42	128.33	64	334.80
-1	-55.30	21	10.91	43	135.65	65	346.70
0	-53.21	22	15.12	44	143.14	66	358.85
1	-51.06	23	19.45	45	150.82	67	371.24
2	-48.83	24	23.90	46	158.68	68	383.88
3	-46.51	25	28.48	47	166.72	69	396.78
4	-44.12	26	33.19	48	174.95	70	409.94
5	-41.65	27	38.04	49	183.38	71	423.35
6	-39.09	28	43.02	50	192.00	72	437.03

Note: All above pressure is gage pressure.

6.2 About refrigerant

6.2.1 Key features of the refrigerant

WMTC chiller use HFO R1233zd (E) as refrigerant. The boiling temperature under atmospheric pressure is 18.26°C. This refrigerant should always be stored in the special vessels. This refrigerant is colorless and inodorous. It is non-combustible under atmospheric pressure.

Warning

In the enclosure space, too much R1233zd (E) may replace the oxygen and lead to asphyxia. So ventilating is necessary for the space which has this refrigerant. Please also protect the body, do not touch the refrigerant by hands or eyes.

6.2.2 Refrigerant pump out and storage

WMTC chillers do not have store function, so the refrigerant should be pumped out to a special vessel if chiller needs to be repaired. Please take care of the chiller during pump out the refrigerant, always keep enough water flow go through the heat exchanger to prevent frozen.

Caution

Always keep enough and continuous water flow goes through the heat exchanger when pumping the refrigerant out.

6.2.3 Refrigerant charge

There are two situations if WMTC chiller has leakage:

1. If the leakage point is located at the negative pressure side, the air will leak into the chiller;
2. If the leakage point is located at the positive pressure side, the refrigerant will leak into the air.
3. The leakage check and the sufficient refrigerant charge indicated on the chiller's nameplate have been completed when the chiller leaves the factory. As the use time increases, the refrigerant charge amount can be appropriately increased or reduced during maintenance to ensure the optimal operating performance of the unit. Please contact local branch for more details.

Normally for the air leak into the chiller, the purge unit will operate and exhaust the air out from the chiller. But if the leakage is higher than the purge capacity, the non-condensable air will remain in the condenser and the condenser pressure will become higher. In this case, the chiller efficiency will decrease and the compressor may get surge. The chiller needs to be checked to find out the leakage point and re-charge the refrigerant.

If the refrigerant leak into the air, the lack of refrigerant may lead to low evaporator pressure alarm or surge. In this case the chiller also needs to be checked.

Before refrigerant charge, please pump the refrigerant out and find out all the leakage points, repair them and confirm the leakage test is successful. Then finish the vacuum and charge the refrigerant by following the procedure at section 3.2.4.

Caution

If the refrigerant need to be recycled, please make sure the refrigerant is pure.

6.3 Confirmation before maintenance

Please confirm the below items before maintenance:

1. Make sure all the other service person know what you are going to do;
2. Confirm all the items listed on "safety considerations" and strictly comply with the requirements;
3. Turn off the power. If the power cannot be off, change the chiller mode to "Local" to prevent the chiller startup according to remote signal.
4. Hang "Maintenance" warning board on the starter and remote equipment.

6.4 Scheduled Maintenance

6.4.1 Maintenance for refrigerant system

The maintenance for refrigerant system includes: record the chiller operation data, check the refrigerant charge regularly. The chiller operation data record should include the pressures, temperatures, power input and amps. The schedule is shown on appendix C.

Record the compressor suction superheat and discharge superheat every month, the superheat is shown on the HMI. Normally when the chiller is operated at full load, the suction super heat is about 0.3 ºC-1.2 ºC and the discharge superheat is 2.5 ºC-4 ºC.

6.4.2 Maintenance for MBC box

Magnetic bearing controller (MBC) box is one of the key components of WMTC chiller, it is important for compressor operation. The maintenance for MBC box is as below:

Warning

The power supply voltage of MBC is 350VDC, please turn off the power before maintenance to prevent electric shock.
The MBC box has been filled with dry nitrogen (the pressure is about 7kPaG) before delivering to the customer side. Once the MBC box need to be opened at the service site (such as magnetic bearing calibration), the operation should be based on the following procedure

a) Discharge the internal gas through the bottom pin valve until the pressure is zero;
b) Unscrew the screw with 1/8 inch Allen key and disassemble the cover plate (please be careful that do not damage the O-ring on the sealing surface).

When the cover plate needs to be re-assembled, the following procedure should be followed:
a) Re-assemble the O-ring and cover plate, tighten the screw with the 1/8 inch Allen key;
b) Fill dry nitrogen into the box through the bottom pin valve slowly, and stop filling until the check valve is open. Then use the suds to find out the leakage point;
c) Using the suds to find out if there are any the leakage points. If there are some leakage points are found, check the bolt around the leakage points or disassemble the shell and change the O-ring;
d) Repeat step a) after fix the leakage points.

Caution

①Please fill the nitrogen into the box slowly, the inner pressure of the box should not higher than 41kPaG.
②Before disassemble the cover plate, please release the pressure from the pin valve first.
③Every time disassemble the shell, the above steps should be done.

6.4.3 Maintenance for electric system

Normally the maintenance for electric system includes the scheduled clean, tighten the bolts and check the temperature rise. For WMTC chiller, please also pay attention to the below items:

1. Confirm the compressor operation amps and compare with the rated amps marked on the nameplate. Normally the actual operation current is lower than the rated amps because the current on the nameplate is the full load current. Also check the current of all the pumps and fans.
2. Confirm all the safety items (except compressor overload) every season, check the safety protect settings. The sensors or components may get offset as time goes on, so this kind of confirmation is necessary and customer can adjust the controller or exchange the components.
3. The interlock of the pump and the water flow switch should be checked to make sure the chiller can shut down once the switch open.
4. Check the starter every season, clean the components and tighten the terminals.
5. Check the resistance between compressor motor and earth every half year. If the resistance is lower than 50MΩ, the insulating layer may lost efficacy and further check should be done to find out the root cause.

Caution

Do not measure the resistance when chiller is doing vacuum. Suggest to measuring the resistance when chiller has been put in the machine room for more than 24 hours. If the power cables connected to compressor terminals have been disassembled, it is necessary to check the phase sequence before power on.

6.4.4 Maintenance for relief valve

The relief valve is the most important safety component to protect the vessels. It should be scheduled maintenance according to the local regulations and all the result should be recorded.

The calibration of relief valve should be done at least every year by the local department or qualified technician. If the relief valve has obvious corrosion or damage, please exchange to a new one. For more detailed calibration items, please take the local regulations as reference.

The construction and disassemble method of the relief valve is shown at section 3.3.3.

Please pay attention to the below items during relief valve maintenance:

1. Do not disassemble both valves on one three-way valve, always keep at least one relief valve

on the vessel to make sure the protection of the vessel.
2. Please plug the connection port of the three-way valve after disassemble the relief valve to prevent leakage.
3. Please confirm the leakage after reassemble the relief valves.

6.4.5 Maintenance for purge unit

Please refer to chapter 5.3 for the maintenance of the purge unit.

6.5 Descaling for water system

Normally the condenser water system is open-type system. When chiller is running, dust and other impurities will mix into the condenser water. That is why condenser water is easily to getting scaling. The scaling has big affection on the chiller efficiency and stability, so it is important to check the water system daily.

Please follow the below requirements:

1. Record the condensation approach temperature every time. If the condensation approach temperature increase very fast, means the condenser tubes have been scaled.
2. Clean the filter or replace it regularly.
3. Clean the condenser tubes at least one time a year.
4. Clean the water pipes regularly.
5. Clean the cooling tower; remove the impurities and alga regularly.

Caution

The tubes and pipes cleaning should be done by qualified service person. Please contact DAIKIN local service department for more support.

6.6 Maintenance for long time standby

If the chiller need to standby for a long time, please also keep the power supply on. On one hand, the electric components will get more life time with power on. On the other hand, the purge unit can keep working to purify the refrigerant.

Caution

If the main power has to be off, please give an independent power to purge unit. Please contact DAIKIN local service department to get information about the purge unit.

After long time standby, if the chiller needs to restart, please follow the below requirements:

6.6.1 Chiller standby

Before chiller standby, change the control mode to “Local” and turn off the manual switch. Hang a signboard on the control panel to prevent mis-operation.

If the chiller located at the place which has environment temperature lower than 0°C, the chiller must disconnect with water system and the water should be completely drained to prevent damage caused by frozen. Use the drain valves on the bottom of the water head to drain the water from vessels, then blowing the dry air into the vessels to dry the tubes.

Caution

If pressure-air is used to dry the tubes, it is necessary to make sure there is no oil in the air, otherwise the nest corrosion will occur and the tubes may be damaged.

During the chiller standby, please pay attention to the below requirements:

1. Take actions to prevent the valves on the water pipes open.
2. Completely drain the water inside the pumps.
3. Check the pipes and the corrosion of the vessels, remove the rust.
4. Operator should also check the chiller regularly and record the data even chiller is standing by.

6.6.2 Restart the chiller

Follow section 4.3.1 to completely check the chiller and water system.

If the starter has any issue, it is dangerous to turn on the power. So it is necessary to check the chiller and all the other components carefully.

All the resistance of the motor coil should be confirmed. If the equaled resistance is lower than 5 MΩ, please check the compressor motor. As the motor is connect with refrigerant, find out the issue in advance is helpful to prevent motor burning and the system cleaning.

6.7 Repair and common issues

If the chiller has been disassembled or the refrigerant system has been opened, leakage test and vacuum should be done according to the following steps.

6.7.1 Leakage test

If the chiller has leakage issue, please stop the chiller and find out the leakage point as below steps:

1. Pump out the refrigerant from chiller to the tank;
2. Fill dry nitrogen into the chiller, increase the inner pressure to 0.3MPa;
3. Check all the connections and welding points to find out all the leakage point;
4. Exhaust the nitrogen until the inner pressure is same as atmospheric pressure, repair all the leakage points.
5. Repeat step 2 and 3 to confirm all the leakage points has been fixed.
6. Fill dry nitrogen into the chiller, increase the inner pressure to 0.3MPa, keep the pressure for at least 30min and check the inner pressure. The pressure should keep stable.

Caution

In order to prevent burning, Please do not use mixed air and refrigerant or oxygen to increase the inner pressure.

6.7.2 Vacuum

Vacuum should be done after leakage test. The vacuum pump should have ability to decrease the inner pressure to less than 67Pa. During vacuum, the vacuum meter or vacuum gage should keep enough distance with the vacuum pump to measure the actual inner pressure.

When the inner pressure is lower than 67 Pa, stop the vacuum pump and keep the chiller for 8 hours. The pressure rise should not more than 56 Pa, otherwise the chiller may still have leakage and need to do the leakage test again.

During the repair process, please take 5.2.2 and 5.2.3 as reference to finish the refrigerant recycling and charging.

6.7.3 Common issues

WMTC chillers operate according to the default logic. Sometimes pre-alarms occurred for short time, it may come from the actual condition exceed the operation range. In this case, the chiller may automatically recovery according to the controller.

If the chiller always has same alarm, that means the actual condition may seriously exceed the normal range or some of the chiller components have been damaged. It is important to find out the root cause to prevent more damage.

The information in the below table 6-1 shows the common issues and the possible causes. Customer can make some preliminary analyzation and contact DAIKIN service to fix the problem.

Caution

Do not start up the chiller before all the issues have been fixed.

Table 6-1 Common issues and the countermeasures of chiller

Alarm information	Possible reason	Countermeasure
Evaporator pressure too low	1.ELWT is too low	Confirm the chilled water flow
	2.Evaporator pressure sensor fault	Change the pressure sensor
	3.Refrigerant is not enough	Charge refrigerant or check leakage
	4.Chilled water flow rate is too low	Check the chilled water pump
	5.EXV fault	Check the EXV movement
Condenser pressure too high	1.CEWT is too high	Check the cooling tower
	2.Condenser pressure sensor fault	Change the pressure sensor
	3.Condenser water flow rate is too low	Confirm the water flow rate
	4.Water valve fault or filter block up	Check the valves and change the filter
	5.Too much scaling on tubes	Clean the tubes
	6.Non-condensation gas mixed into	Operate the purge unit
IGV fault	1.IGV driver has no power	Check the power supply of the driver
	2.IGV position sensor fault	Check the feedback voltage of the driver
	3.IGV jammed	Disassemble the compressor
Low current	Minimum current setting is wrong	Reset the current
High current	1.Compressor overload	Limit the load
	2.Motor damaged	Change motor
	3.RLA setting fault	Change RLA setting
High pressure switch alarm	1.Condenser pressure fault	Replace if damaged
	2.High pressure switch fault	Replace if damaged
Discharge temperature high	Discharge temperature sensor fault	Replace if damaged
Motor temperature high	1.Stator/gap temperature sensor fault	Replace if damaged
	2.Cooling valve not open	Open the valve
	3.Cooling filter blocked	Replace the filter
Starter fault	1.Contactor fault	1.Check and repair the contactor
	2.Relay fault	2.Check the relay and fix the problem
	3.VFD has alarm	3.Check the VFD and fix the problem
	4.Power supply fault	4.Check the power to confirm the voltage is within ±10% of the rated voltage, confirm the phase sequence and restart the starter
Compressor surge	1.EXV position fault	1.Replace the EXV if damaged
	2.Actual lift is too high	2.Confirm the cooling tower and the flow rate of both evaporator and condenser
	3.Approach temperature too high	3.Clean the condenser tubes
	4.Actual demand is too low	4.Change the minimum RLA setting
Sensor fault	1.Sensor damaged	1.Replace if damaged
	2.Wirings disconnected	2.Check the wirings and tighten the terminals

7 Chiller scrapping

Please follow the below guides to scrap the chiller:

1. Please apply to abolish the pressure vessel registering before chiller scrapping.
2. Please pump the refrigerant out of the chiller and send the refrigerant to the local certified company. Do not just drain the refrigerant away without any treatment.
3. The chiller should be recycled by the certified company. Any person or company without certification is forbidden to disassemble and recycle the chiller.
4. Incorrect treatment for the electronic components on the chiller will pollute the environment.

DAIKIN requires the chiller should not be scrapped as normal household waste or industrial waste. Please follow the local rules to make sure the chiller storage and scrapping has no harmful to the environment.

Please do not put the electronic waste together with the household waste. Please get the information and suggestion for chiller scrapping.

See appendix E to get the harmful matter content.

The effluents such as saline water, cleanout fluid and refrigerant should be disposed follow the local rules. Dispose the effluents unlawful is harmful to the environment and human health.

Ⅱ Technical parameters section

1 Unit component parameter

1.1 Parameters of Evaporator

Table 2-3 Major parameters of evaporator

Model	Tube length (ft)	Net weight (kg)	Water volume (kg)	Pass	Relief valve No.
F4214-PU	14	4035	817	2	2
F4814-PU	14	5670	1212	2	2
F5414-PU	14	7900	1784	2	2

Note: The dimensions and weights are for reference only, subject to the actual situation.

1.2 Parameters of Condenser

Table 2-4 Major parameters of condenser

Model	Tube length (ft)	Net weight (kg)	Water volume (kg)	Pass	Relief valve No.
C3314-EP	14	3460	1003	2	2
C3614-EP	14	4340	1267	2	2

Note: The dimensions and weights are for reference only, subject to the actual situation.

2 Installation

2.1 WMTC Lifting parameters

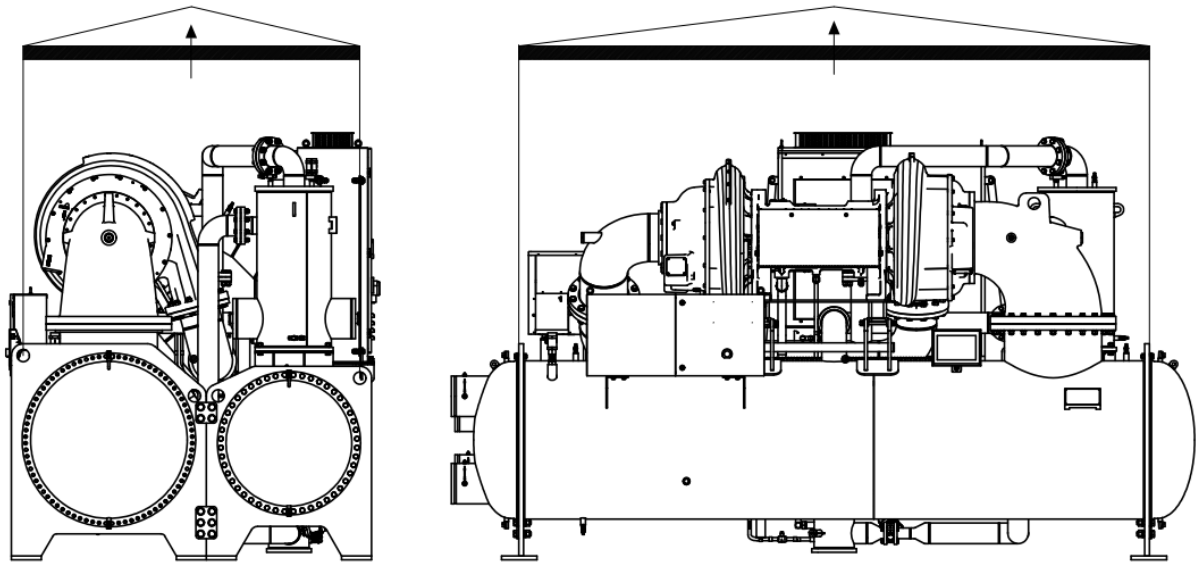


Fig. 3-1 WMTC chiller lifting guide

Table 3-1 Weight of the standard configuration

Chiller model	Shipping weight (kg)	Operation weight (kg)
WMTC/50B/F3914-PU/C3314-EP	11610	13450
WMTC/50B/F4214-PU/C3314-EP	12079	14079
WMTC/80B/F4814-PU/C3614-EP	17798	20498
WMTC/80B/F5414-PU/C3614-EP	20077	23323

2.2 WMTC foundation parameters

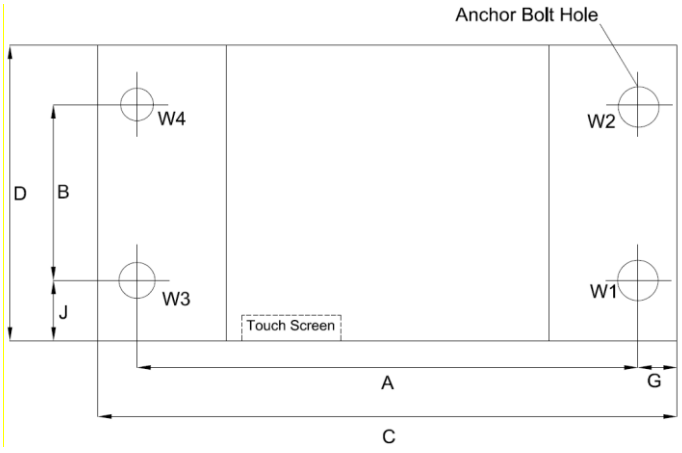


Fig. 3-3 WMTC foundation drawing

Table 3-2 Foundation drawing parameters Unit: mm

Model	A	B	C	D	G	J
WMTC/50B/F3914/C3314	4432	2237	4932	2737	250	250
WMTC/50B/F4214/C3314	4432	2237	4932	2737	250	250
WMTC/80B/F4814/C3614	4432	2597	4932	3097	250	250
WMTC/80B/F5414/C3614	4373	2759	4873	3259	250	250

2.3 WMTC Load of the chiller feet

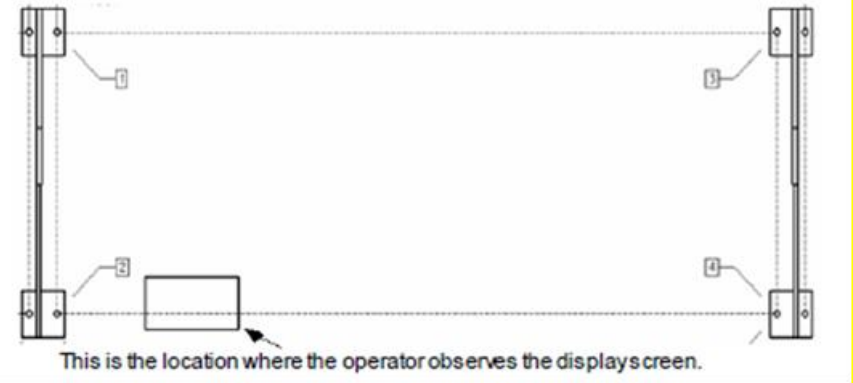


Fig. 3-4 Schematic of the chiller feet

Table 3-3 Load of the chiller feet Unit: kg

Model	Recommend load			
	Foot 1	Foot 2	Foot 3	Foot 4
WMTC/50B/F3914/C3314	3349	3939	2786	3376
WMTC/50B/F4214/C3314	3524	4170	2869	3516
WMTC/80B/F4814/C3614	5447	5469	4780	4802
WMTC/80B/F5414/C3614	5968	6235	5427	5693

2.4 WMTC maintenance clearance

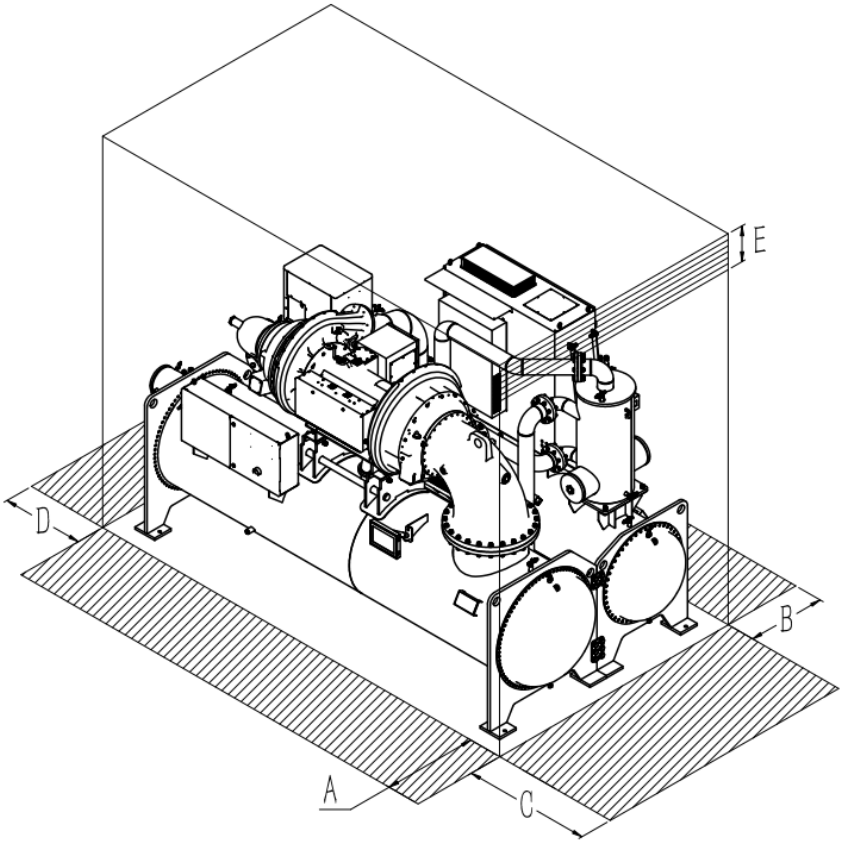


Fig. 3-6 Maintenance clearance of WMTC chiller

Table 3-4 dimensions of WMTC maintenance clearance Unit: mm

Length of evaporator/condenser(ft/m)	A	B	C	D	E
14/4.27	≥1000	≥1500	≥4280	≥1000	≥1000

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

3 Wirings

1. Power cable

Table 3-7 Cable size

Input voltage (V)	Maximum current (A)	Cable length (m)	Sectional area for each phase(mm2)
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

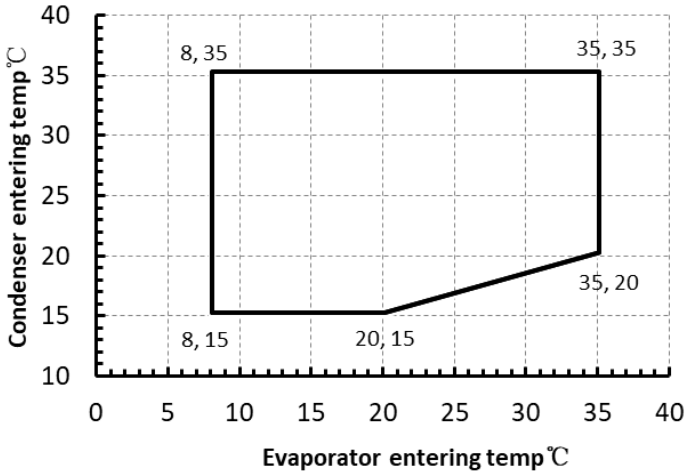
2.Tightening torque

Table 3-8 Tightening torque

Bolt size(mm)	Torque(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

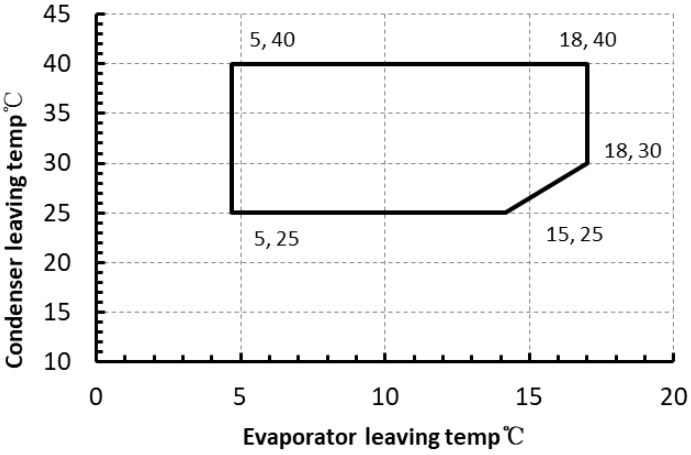
4 Operation range

4.1 Startup range



Note：
1. Based on 5°C temperature difference;
2. The condenser water temperature should be higher than chilled water temperature within 5min after chiller startup, otherwise please follow 4.1.3 to add bypass on condenser pipe.

4.2 Operation range



Caution

The operation range shows the water temperature limitation for the chiller. Chiller may not provide rated capacity at every condition especially at the boundary point. The unloading capacity will also change if the chiller is not operating at rated condition.

Appendix A Check list before initial startup

Item	Yes	No
Ⅰ Chilled water system		
Pipes connected correct		
The air has been completely exhausted and pipes are full with water		
Water pump installed correct (rotation direction has been confirmed)		
Valves installed correct and operation without alarm		
Water flow is stable and within the range (record the value)		
Ⅱ Condenser water system		
Pipes connected correct		
The air has been completely exhausted and pipes are full with water		
Water pump installed correct (rotation direction has been confirmed)		
Valves installed correct and operation without alarm		
Water flow is stable and within the range (record the value)		
Ⅲ Chiller		
Relief valves have been connected to outdoors correct		
Motor cooling valve full open		
EXV movement is correct		
IGV calibration succeed		
Temperatures and pressures on HMI are correct		
No alarms on HMI		
Safety settings have been confirmed		
Purge unit operated normally		
Ⅳ Electric		
The field wiring has connected to control box		
The power cable for starter and compressor has been connected correct		
All the control wirings have been connected correct		
Starter current satisfy the requirement		
Power cable for pumps has been connected correct		
Power cable for cooling tower has been connected correct		
Ⅴ Shaft float test		
Shaft float without any alarm		
Chiller ready to start according to correct procedure		
Ⅵ Purge unit		
Purge unit operation mode is correct		

Appendix B Refrigerant temperature-pressure table

R1233zd (E) temperature-pressure table

R1233zd(E) saturated temperature-pressure table							
°C	kPa	°C	kPa	°C	kPa	°C	kPa
-15	-77.60	7	-36.44	29	48.13	51	200.81
-14	-76.38	8	-33.70	30	53.39	52	209.83
-13	-75.10	9	-30.88	31	58.79	53	219.05
-12	-73.78	10	-27.96	32	64.33	54	228.48
-11	-72.40	11	-24.95	33	70.02	55	238.12
-10	-70.97	12	-21.84	34	75.87	56	247.97
-9	-69.48	13	-18.62	35	81.86	57	258.03
-8	-67.93	14	-15.31	36	88.01	58	268.32
-7	-66.32	15	-11.90	37	94.32	59	278.83
-6	-64.65	16	-8.37	38	100.79	60	289.56
-5	-62.91	17	-4.74	39	107.42	61	300.52
-4	-61.11	18	-1.00	40	114.22	62	311.71
-3	-59.24	19	2.85	41	121.19	63	323.13
-2	-57.31	20	6.82	42	128.33	64	334.80
-1	-55.30	21	10.91	43	135.65	65	346.70
0	-53.21	22	15.12	44	143.14	66	358.85
1	-51.06	23	19.45	45	150.82	67	371.24
2	-48.83	24	23.90	46	158.68	68	383.88
3	-46.51	25	28.48	47	166.72	69	396.78
4	-44.12	26	33.19	48	174.95	70	409.94
5	-41.65	27	38.04	49	183.38	71	423.35
6	-39.09	28	43.02	50	192.00	72	437.03

Note: All above pressure is gage pressure

Appendix C Maintenance schedule

Maintenance items \ Schedule	Day	Week	Month	Season	Year	3 years	5 years
Ⅰ Chiller							
Operation data record	O						
Check the operation data		O					
Leakage test				O			
Relief valve calibration					√		
Ⅱ Compressor							
Vibration test					×		
A. Motor							
● Operation current fluctuation (within 10%)				O			
● Terminal temperature					×		
● Check motor cooling filter pressure drop					×		
B. MBC							
Check MBC inner pressure			O				
Shaft position calibration					×		
Ⅲ Control system							
A. Check the control items							
● Temperature sensor calibration					×		
● Pressure sensor calibration					×		
● EXV calibration					×		
● Check the RLA setting					×		
● Check the actual RLA					×		
B. Check protection items							
● Check the alarm relay				×			
● Check pump interlock				×			
● Check the safety settings				×			
Ⅳ. Evaporator and condenser							
A. Approach temperature evaluation			O				
B. Water quality test				√			
C. Clean the condenser tubes					×		
D. Tube thickness test by eddy current							√
E. Water pressure drop test				O			
Ⅴ. Economizer							
A. Float valve evaluation		O					
Ⅵ. EXV							
A. Check the stability of the liquid level				×			
Ⅶ. Motor cooling filter							
A. Check the pressure drop					×		
Ⅷ. Purge unit							
A. Check the humidity in suction pipe		O					
B. Clean the air-cooled condenser					O		

O-Done by customer; ×-Done by DAIKIN service √-Done by third-party

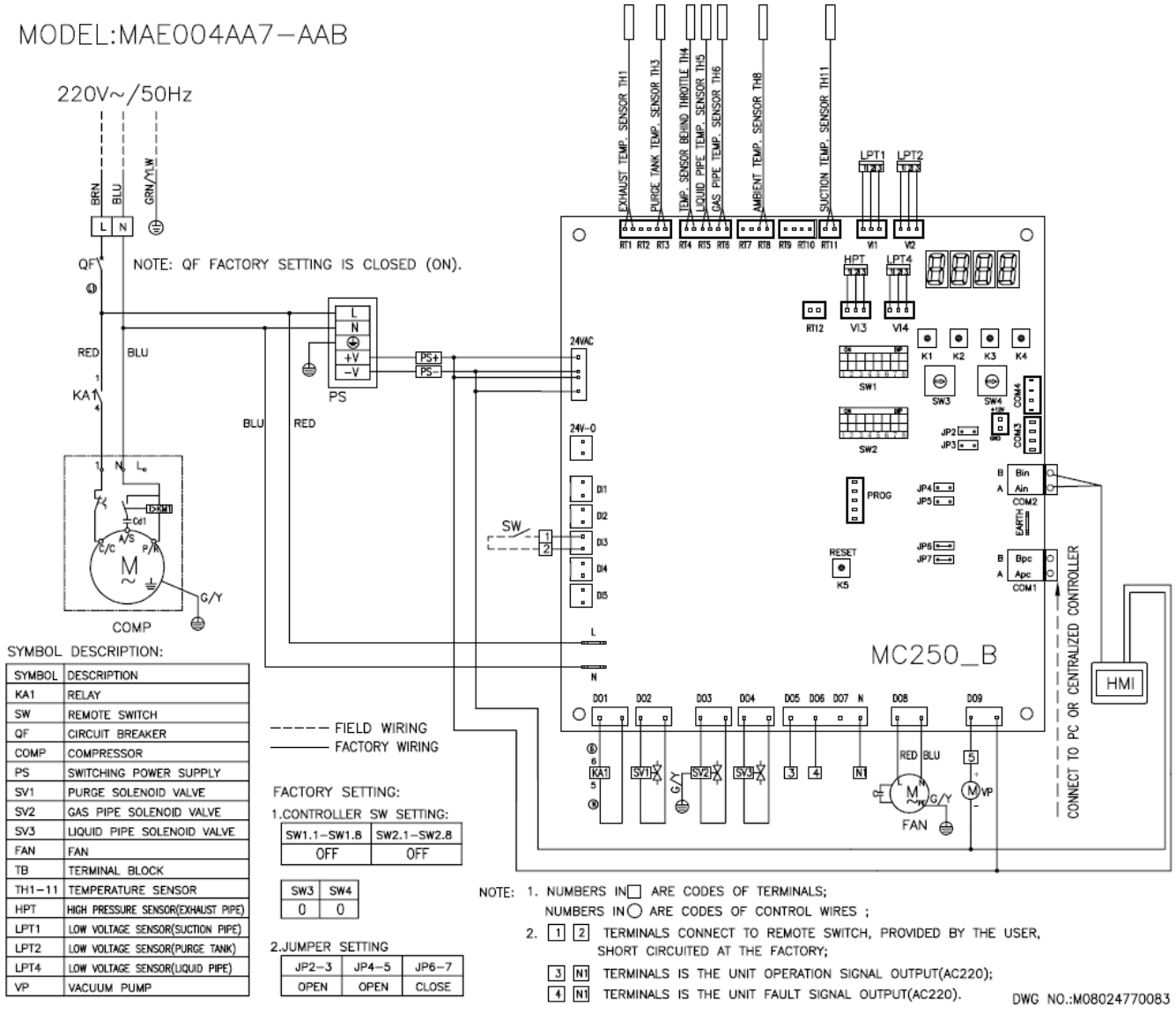
Note:

1. The approach temperature (equal to the difference between outlet temperature and saturated temperature) of evaporator and condenser is the key value to evaluate the scaling inside the tubes. Especially, ① When the condenser water flow rate is constant, the approach temperature will be more accurate to evaluate the scaling; ② When the condenser approach temperature suddenly increased, it means refrigerant system may have mixed in

non-condensable gas. The approach temperature can be got from HMI easily. DAIKIN high-efficiency heat exchanger has very low designed approach temperature about 0.6~1.2°C, when the approach temperature increase to higher than 2°C, it means the tubes may have scaling or the refrigerant system may have mixed in non-condensable gas. The discharge pressure and operation current are the other points to evaluate the scaling or leakage.

2. Normally the chilled water system is closed cycle, so it is hard to get scaling. But the scheduled evaluate is also important to confirm the scaling in advance.
3. After the expiration of the contract, DAIKIN will no longer provide the original standard service.

Appendix D Electrical schematic of purge unit



SYMBOL DESCRIPTION:

SYMBOL	DESCRIPTION
KA1	RELAY
SW	REMOTE SWITCH
QF	CIRCUIT BREAKER
COMP	COMPRESSOR
PS	SWITCHING POWER SUPPLY
SV1	PURGE SOLENOID VALVE
SV2	GAS PIPE SOLENOID VALVE
SV3	LIQUID PIPE SOLENOID VALVE
FAN	FAN
TB	TERMINAL BLOCK
TH1-11	TEMPERATURE SENSOR
HPT	HIGH PRESSURE SENSOR(EXHAUST PIPE)
LPT1	LOW VOLTAGE SENSOR(SUCTION PIPE)
LPT2	LOW VOLTAGE SENSOR(PURGE TANK)
LPT4	LOW VOLTAGE SENSOR(LIQUID PIPE)
VP	VACUUM PUMP

----- FIELD WIRING
——— FACTORY WIRING

FACTORY SETTING:

1.CONTROLLER SW SETTING:

SW1.1-SW1.8	SW2.1-SW2.8
OFF	OFF

SW3	SW4
0	0

2.JUMPER SETTING

JP2-3	JP4-5	JP6-7
OPEN	OPEN	CLOSE

NOTE: 1. NUMBERS IN□ ARE CODES OF TERMINALS;
NUMBERS IN○ ARE CODES OF CONTROL WIRES ;
2. [1] [2] TERMINALS CONNECT TO REMOTE SWITCH, PROVIDED BY THE USER, SHORT CIRCUITED AT THE FACTORY;
[3] [N1] TERMINALS IS THE UNIT OPERATION SIGNAL OUTPUT(AC220);
[4] [N1] TERMINALS IS THE UNIT FAULT SIGNAL OUTPUT(AC220).

DWG NO.:M08024770083

Appendix E Harmful matter table of chiller

Harmful matter table of chiller						
Chiller components	Harmful matter					
	Pb	Hg	Cd	Cr(VI)	PBB	PBDE
Compressor	×		×	○	○	○
Heat exchanger	○	○	○	○	○	○
Pipes and valves	×	○	×	×	○	○
Refrigerant	○	○	○	○	○	○
Starter	×	×	×	×	×	×
Control box	○	○	○	○	○	○
Electric components	×	×	×	×	×	×
Bolt or other fasteners	×	○	○	○	○	○
Rubber and plastic	×	×	×	×	×	×
Insulation	○	○	○	○	○	○
Glues and tapes	×	×	×	×	×	×
Other metals	○	○	○	○	○	○
Printed documents	×	×	×	×	×	×

This table is compiled according to SJ/T 11364

○: Means the harmful matter amount in these components is lower than the limitation on GB/T 26572

×: Means the harmful matter amount in these components exceeds the limitation on GB/T 26572. But it is hard to remove all the harmful matter according to the existing technical ability. DAIKIN will continuous improve the technical ability to reduce the harmful matter amount.

Appendix F Main Settings of WMTC standard chiller

Description	Default	Adjustable range
Water		
Leaving Water Temp - Cool	7.0°C	3.0 - 18.0°C
Startup Delta T	1.7°C	0.0 - 5.6°C
Stage Delta T	0.6°C	0.0 - 5.6°C
Shutdown Delta T	1.7°C	0.0 - 1.7°C
LWT Reset Type	NONE	NONE, RETURN, 4-20mA
Maximum Reset Delta T	0.0°C	0.0 - 11.2°C
Start Reset Delta T	5.6°C	0.0 - 11.2°C
Mode		
Unit Enable	OFF	OFF, Auto
UNIT Mode	Cool	NA, Cool, Ice
Control Source	Local	Local, Switches, BAS
Evaporator Pump	Only #1	Only #1, Only #2, Auto, #1 Primary, #2 Primary
Condenser Pump	Only #1	Only #1, Only #2, Auto, #1 Primary, #2 Primary
Motor		
Demand Limit	OFF	OFF, ON
Minimum Amps	5%	0 to 20%
Maximum Amps	100%	10 to 100%
Nameplate RLA	120Amps	85 to1000Amps
Alarm		
Low Suction Pressure - Stop	48kPa	42 - 54kPa
High Discharge Pressure - Stop	237kPa	183 - 293kPa
High Discharge Temperature - Stop	60°C	60 - 90°C
Surge Temperature Limit	7°C	1 - 14°C
Surge Slope Limit	11°C/min	1 - 55°C/min
Motor Current Threshold	3%	3 - 20%
High Stator Temp - Stop	55°C	48 - 80°C
Evaporator Freeze Protect	1.1°C	-22.7 – 7.2°C
Condenser Freeze Protect	1.1°C	-22.7 – 7.2°C
Timer		
Evap Recirculate Timer	0.5min	0.2 to 5min
Start to Start Timer	5min	2 to 60min
Stop to Start Timer	3min	1 to 20min
Unload Timer	30s	10 to 240s

Appendix G Air conditioning unit grounding system requirements

1.1 Recommended power distribution system

For single-power systems, TN-S systems are recommended, where the entire system should use a separate PE, and the PE of the device can also be separately grounded (Figure A-1-1). A neutral bar (insulator) and a ground copper bar are provided as standard in all our starting cabinets. The diameter of the on-site neutral wire is recommended to be≥16mm^2.

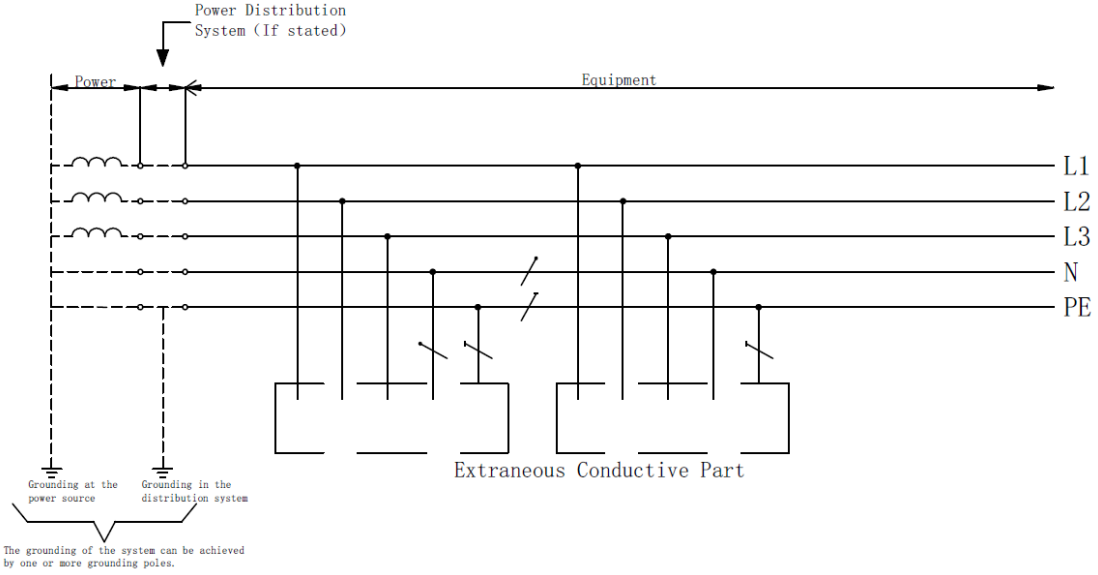


Figure A-1-1 System-wide TN-S system where N and PE are separated

1.2 Independent grounding system

Here are two common ways to deal with an independent grounding system:

(1) If the power supply system cannot provide an independent grounding system, add an independent grounding terminal near the air conditioning unit. The resistance of the grounding pole must be less than 3 ohms.

(2) The grounding system that is designed and built separately with the grounding electrode can avoid interference problems caused by grounding problems in the unit. This grounding scheme is recommended when one or more of the following situations occur at the customer site:

a. The grounding situation of the customer site cannot be confirmed, and the connection between the grounding copper bar and the earth of the unit cannot be determined;
b. The high-power inverter and the air conditioning unit on the customer's site use the same grounding copper bar;
c. When the building lighting protection grounding is used as the unit grounding on the customer site;
d. The equipment currently used at the customer site has unexplained fluctuations similar to the sensor, the indicator light blinks, the current display is not zero in the shutdown state, etc.

1.3 Requirements for grounding electrode

(1) The material and size of the grounding pole should be selected so that it is corrosion-resistant and has appropriate mechanical strength. The minimum size of the ground pole for commonly used materials buried in the soil required for corrosion-resistant and mechanical strength shall comply with the provisions of Table 1-3-1.

Table 1-3-1 Minimum dimensions of ground poles for commonly used materials embedded in soil for corrosion resistance and mechanical strength requirements

Materials	Surface	Shapes	Minimum size				
			Diameter（mm）	Cross-sectional area（mm^2）	Thichness（mm）	Thickness of plating/sheath（μm）	
						Individual value	Average
steel	Hot-dip falvanized or stainless steel	Ribbon	--	90	3	63	70
		Profiles	--	90	3	63	70
		Round rod for burying ground poles deep	16	--	--	63	70
		Round wire for shallow ground poles	10	--	--	--	50
		Tubular	25	--	2	47	55
	Protective cover	Round rod for burying ground poles deep	15	--	--	2000	--
	Plated copper sheathing	Bury the horizontal grounding pole deeply	--	90	3	70	--
		Round rod for burying ground poles deep	14	--	--	254	--
copper	Bare	Banding	--	50	2	--	--
		Round wire for Shallow ground poles	--	25	--	--	--
	——	twine	Each strand 1.8	25	--	--	--
		tubular	20	--	2	--	--
	Tinning	Stranded wire	Each 1.8	25	--	1	5
	Galvanize	Ribbon	--	50	2	20	40

Note:

① Hot dip galvanized or stainless steel can be used as electrodes buried in concrete;

② Stainless steel without plating;

③ The steel strip is a rolled strip or cut strip with a round edge;

④ Copper galvanized strip is a strip with a round edge;

⑤ In places with very low corrosion and mechanical damage, the cross-section of copper round wire can be 16mm^2;

⑥ Shallow buried refers to the buried depth of not more than 0.5m.

(2) The grounding pole should be selected according to the soil conditions and the required grounding resistance value.

(3) The following facilities can be used in the grounding pole:

① The underground metal structure network embedded in the foundation (foundation grounding);

② Metal plate;

③ Steel bars buried in underground concrete (except pre-stressed concrete);

④ Rods or pipes;

⑤ Metal bands or wires;

⑥ Metal sheath and other metal sheath for cables according to local conditions or requirements;

⑦ Other suitable underground metal mesh set according to local conditions or requirements.

(4) When selecting the type of grounding pole and determining its buried depth, it should comply with the current national standard “Building Electrical Installation Part4-41”: The relevant provisions of GB16895.21 for protection against electric shock, and taking into account local conditions, shall prevent the grounding resistance of the grounding pole from increasing to

the extent that the electric shock protection measures are compromised in the case of dry and frozen soil.

(5) Attention should be paid to the electrolytic corrosion problem when using different materials in the grounding configuration;

(6) Metal pipes used to transport flammable liquids or gases should not be used as grounding poles.

The grounding conductor (wire) should meet the following requirements:

The minimum cross-sectional area of the ground conductor (wire) buried in the soil should meet the requirements of Table 1-3-2.

Table 1-3-2 Minimum cross-sectional area of a ground conductor (wire) buried in soil

Protection against corrosion	Protection against mechanical damage	No protection against mechanical damage
Yes	Copper: 2.5mm^2 Steel: 10mm^2	Copper: 16mm^2 Steel: 16mm^2
No	Copper: 25mm^2	Steel: 50mm^2

The grounding conductor (wire) should be firmly connected to the grounding pole, and should have good electrical conductivity, and should be connected by exothermic welding, fixture or other mechanical connectors. The plate plated with colored zinc and the electrolytic plate and the wiring terminal plated with tin, the copper bar plated with nickel, the conductive oxidation of aluminum alloy and other materials meets the requirements and will not cause chemical corrosion.

The mechanical connector should be installed according to the manufacturer's instructions. When using the fixture, do not damage the grounding pole or the grounding conductor (wire).

1.4 Ground lapping

A lap joint is the creation of an electrical connection path with a sufficiently low impedance between two metal objects. This article is mainly to specify the lapping design of the protective ground to ensure that the structural parts form a complete equipotential body.

1.4.1 General requirements for lap joint design

- Ensure that the lap surface has good electrical conductivity

  The surface of the structure and the cable connection terminals must be conductive or treated with conductive materails. At present, the commonly used stainless steel materials, copper alloy, galvanized passivation of steel plate, nickel plating treatment, conductive oxidation treatment of aluminum plate, tin plating treatment of terminal surface can meet the requirements. If the structural parts take into account the needs of rust prevention and spray painting treatment, the lap surface must be protected, and spray painting is prohibited.

- Ensure that the lap surfaces are cleaned

  Lap surfaces must be clean and free of dust, oil film, paint, oxide, anodized film, and other non-conductive materials. If the structural parts are pained, it is especially necessary to pay attention to reliable spray paint protection, and the lap surface must not be painted.

- Ensure reliable contact between lap surfaces

  Only the form of surface contact is allowed to achieve the lap, not through the thread lap, cannot rely on the rivet to achieve the lap, and do not allow point contact, line contact form lap. The relative motion of the parts between the lap wire lap, cannot rely on the guide rail, pin and other active connection mode for lap.

- Ensure that the lap joint surface has enough fastening force

  For single point lap joints, screw connection, welding form can be used, and riveted form can be used for restrictions. When using the screw external connection, MS or large screw connection must be used. The fastening force of the screw should meet the torque requirements specified in the existing process documents. In addition, the screw should have an anti-loosening device to ensure that it will not fall off.

- Ensure sufficient contact area
  For a single point lap joint, the diameter of the lap joint should be greater than 15mm. For multi-point lap joint, the general scheme has met the requirements, not overlapping the joint area is limited.
- Ensure that all metal structural parts should be reliably connected.
- Ensure that the joints are protected from electrochemical corrosion
  When the joint surfaces are paired with different materials, chemical corrosion may occur. This electrochemical corrosion will obviously have a huge impact on the performance of the joint.
- At present, in the commonly used material pairing, the contact between the steel plate with colored zinc and the electrolytic plate and the wiring terminal plated with tin, the copper bar plated with nickel, the conductive oxidation of aluminum alloy and other materials meets the requirements and will not cause chemical corrosion.
- The contact between conductive oxidation and other materials of aluminum alloy is in line with the requirements, and electrochemical corrosion will not occur.
- Aluminum alloy conductive oxidation and wiring terminal tin plating, copper nickel plating between the harsher environment will likely produce slight electrochemical corrosion, taking into account the current practical application needs, allow to continue to use, but need to ensure its application of the process, and as far as possible to avoid the use of these pairing forms.
- Whether other types of material pairing can be used needs to be confirmed that there will be no electrochemical corrosion.
- In principle, the fastening of lap points shall not use self-tapping screws. When self-tapping screws must be used in special occasions, it is necessary to ensure that the screws do not need to be removed during maintenance.

1.4.2 Requirements for lapping resistance

- The bonding resistance between the cable shielding layer, connectors , and structural components: less than 50mΩ；
- The bond resistance between the filter housing and the structural part less than 50 mΩ；
- The bond resistance between the ground wire and the structural part less than 10 mΩ;
- Independent safety protection ground resistance should be less than or equal to 4Ω；
- Independent AC working ground resistance should be less than or equal to 4Ω；
- Independent DC working ground resistance should be less than or equal to 4Ω；
- The common grounding body (joint grounding) should not be greater than 1Ω of the grounding resistance.

1.4.3 Requirements for the Ground Cable (copper bar)

The minimum cross-sectional area of PE should meet the following requirements:

Table 1-4-3 Minimum cross-section area of PE (It is required that PE and phase line use the same material)

The cross-sectional area of the phase line of the unit's power supply S	Minimum cross-sectional area of the external protective wire S_P
S≤16	S
16＜S≤35	16
S＞35	S/2

1.4.4 The ground terminal shall meet the following requirements:

A general ground terminal shall be provided in every device using a protective connection and the following wires shall be connected to it:

(1) Protective connection conductor (wire);
(2) Ground conductor (wire);
(3) PE (when PE has been connected to the total ground terminal through other pes, each PE should not be directly connected to the total ground terminal);

(4) Functional ground conductor (wire) .each conductor connected to the total ground terminal should be securely connected and can be separately disassembled.

1.4.5 Requirements for on-site neutral wiring:

(1) The neutral line installation device is reserved in the starting cabinet of all chillers;

(2) Neutral line is not available on site. If a neutral cable is provided onsite, the diameter of the neutral cable is at least 16mm^2.

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 information

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